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of the Association of American Geographers

HENRY MADISON KENDALL
Editor

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Statements and opinions in the ANNALS *are the responsibility of authors and do not necessarily reflect the views of the Association*

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PROGRAM

50th Anniversary Meeting Association of American Geographers

APRIL 11, 12, 13, 14, 15, 1954
at the
UNIVERSITY OF PENNSYLVANIA
and the
PENN-SHERWOOD HOTEL
Philadelphia, Pennsylvania

General Information

Meetings will be held in the Della Robbia Room of the Penn-Sherwood Hotel and in Dietrich Hall, University of Pennsylvania. The University of Pennsylvania is the host institution. Sessions in Dietrich Hall will be held in rooms as indicated on the program. Attention is called to the material on display in the Ballroom, adjacent to the Della Robbia Room, and in the corridors of Dietrich Hall.

On Sunday, April 11 there will be an all-day field trip by chartered bus across the coastal plain of New Jersey. There will be an opportunity to examine the Pine Barrens and their vegetation, shore forms on the barrier-beach coast, and recreational development at Atlantic City. Reservations, together with check for $3.00 to cover transportation (lunch not included), should be in the hands of L. E. Klimm, W-168 Dietrich Hall, University of Pennsylvania, Philadelphia 4, Pa., by *April 1*. If sufficient registration is not forthcoming, members will be notified immediately and checks will be returned. Buses will leave Penn-Sherwood Hotel, 39th and Walnut Sts., Philadelphia at 9:30 A.M., Sunday, April 11.

On Tuesday afternoon there will be a tour of historic sites in Philadelphia,† followed by a tea at which the Geographical Society of Philadelphia will be host. Thursday will be devoted to an all-day field trip† to the new industrial, commercial, and residential developments triggered by the erection of the Fairless Works of United States Steel Corporation in lower Bucks County, Pennsylvania, after 1950.

Regional and special university group breakfasts and luncheons may be scheduled as desired. The Local Arrangements Committee has arranged a program of events for the wives of geographers who may not be interested in attending all meetings. The program of events for the ladies, as well as tickets for the banquet and the Tuesday and Thursday field trips, may be secured at the registration desk in the lobby of the Penn-Sherwood Hotel.

COMMITTEE ON LOCAL ARRANGEMENTS

WILLIAM F. CHRISTIANS, University of Pennsylvania, *Chairman*
GILBERT F. WHITE, Haverford College
JAMES J. FLANNERY, University of Pennsylvania
DONN K. HAGLUND, University of Pennsylvania
JAMES P. LATHAM, University of Pennsylvania

† The Tuesday tour will cost $1.65 per person; the Thursday field trip will cost $2.25 per person, not including meals.

Exhibits

Members having professional material to exhibit should communicate with James J. Flannery, 182 Dietrich Hall, University of Pennsylvania, Philadelphia 4, Pennsylvania. Commercial exhibits are in charge of Donn K. Haglund, 209 S. 36th St., Philadelphia 4, Pennsylvania.

The Organization of the Program

The program committee was appointed by the Council and instructed by it to arrange a program of invited papers suitable for the Fiftieth Anniversary meetings. The committee assumed responsibility for the two General Sessions and for inviting twelve others to arrange, in turn, programs on specific themes. The committee regrets its inability to find places for many papers voluntarily submitted, which, in the nature of these plans, could not be scheduled. It does, however, offer the following program with confidence that it will appropriately represent the highest standards of thinking and research in American geography at mid-century. Although each General Session paper and each Group Session has specially invited critics, the committee warmly invites free and open discussion by the membership of all papers presented and it has so advised the chairmen of all sessions.

Program Committee

ANDREW H. CLARK, University of Wisconsin, *Chairman*
LESTER E. KLIMM, University of Pennsylvania
WALTER W. RISTOW, Library of Congress
ARTHUR H. ROBINSON, University of Wisconsin
JOHN K. WRIGHT, American Geographical Society

Schedule of Program

SUNDAY, APRIL 11

9:30 A.M. ALL DAY FIELD TRIP. (See *General Information* for details)

MONDAY MORNING, APRIL 12

8:30 A.M. REGISTRATION—*Lobby of the Penn-Sherwood Hotel*

10:30 A.M. GENERAL ASSEMBLY—*Della Robbia Room*

J. RUSSELL WHITAKER, The George Peabody College for Teachers, presiding

GAYLORD P. HARNWELL, President of the University of Pennsylvania
Welcome by the Host Institution

LESTER E. KLIMM, University of Pennsylvania
Welcome by the Host Department

J. RUSSELL WHITAKER, President of the Association of American Geographers
Response to Addresses of Welcome

HENRY MADISON KENDALL, Miami University
On the Beginnings and Progress of the Association

WILLIAM F. CHRISTIANS, University of Pennsylvania
The Convention Routine: Questions, Answers, Announcements

MONDAY AFTERNOON, APRIL 12

1:30 P.M. GENERAL SESSION—*Della Robbia Room*

BREAKING NEW GROUND IN AMERICAN GEOGRAPHY

GUY-HAROLD SMITH, The Ohio State University, presiding
Arranged by the Program Committee

STEPHEN B. JONES, Yale University
Possibilism and Strategic Thought
Formal critics:
John A. Morrison, Quincy, Illinois
George Tatham, University of Toronto

JOHN E. KESSELI, University of California, Berkeley
A Geomorphology Suited to the Needs of Geographers
Formal critics:
George B. Cressey, Syracuse University
Benjamin A. Tator, Gulf Oil Corporation

FRED B. KNIFFEN, Louisiana State University
Whither Cultural Geography?
Formal critics:
Jan O. M. Broek, University of Minnesota
Charles A. Fisher, University College, Leicester, England; (Visiting Lecturer, Yale University)

PAUL A. SIPLE, Department of the Army
The Possible Mechanics of Polar Migration
Formal critics:
Wallace W. Atwood, Jr., National Academy of Sciences
Frank B. Wood, University of Pennsylvania

MONDAY EVENING, APRIL 12

8:00 P.M. THREE CONCURRENT GROUP SESSIONS

Session A—CARTOGRAPHY—*Ballantyne Auditorium, Dietrich Hall*
ERWIN RAISZ, Clark University (Visiting Professor), presiding
Arranged by the chairman

ERWIN RAISZ, Clark University (Visiting Professor)
The Changing Concepts of Maps through History

MAMIE L. ANDERZHON, Wm. Beye School, Oak Park, Illinois
The Child Looks upon the Map

ARCH C. GERLACH, Library of Congress
The Public Attitude in the United States toward Maps

ROBERT L. WILLIAMS, Yale University
Visual Interpretation of Value Symbols on Maps

J. ROSS MACKAY, University of British Columbia
Experiments with some Symbols and Map Projections

Business meeting of Committee on Cartography, AAG, and report by Chairman Raisz

Session B—POLITICAL GEOGRAPHY—*Alumni Auditorium, Dietrich Hall*
GEORGE KISH, University of Michigan, presiding
Arranged by the chairman

RICHARD HARTSHORNE, University of Wisconsin
The Geography of the Balance of Power
Formal critics:
Jan O. M. Broek, University of Minnesota
Derwent Whittlesey, Harvard University

S. WHITTEMORE BOGGS, Department of State
Global Relations of the United States
Formal critics:
Charles M. Davis, University of Michigan
Fred E. Dohrs, Wayne University

TREVOR LLOYD, Dartmouth College
The North American Arctic in World Affairs
Formal critics:
F. Kenneth Hare, McGill University
N. L. Nicholson, Department of Mines and Technical Surveys, Canada

Session C—APPLIED GEOGRAPHY—*Room E-8, Dietrich Hall*

JOSEPH A. RUSSELL, University of Illinois, presiding
Arranged by the chairman

JOSEPH A. RUSSELL, University of Illinois
The Theory and Practice of Applied Geography

WILBUR R. LAMB, Chesapeake and Ohio Railway Company
Geography as Applied to Railroad Industrial Development

DONALD M. ROZNOWSKI Department of Commerce, State of New York
Applied Geography in the Industrial Development Program of the New York State Department of Commerce

ALAN S. GARDNER, Kaiser Aluminum and Chemical Corporation
Applications of Geography in Marketing Research

JOHN C. HOFER, Denoyer-Geppert Company
Applied Geography in the Field of Publishing

MELVIN R. WALSH, Crane Company
An Analysis of the Harvey, Illinois, Female Labor Market

IVAN J. WARREN, Chesapeake and Ohio Railway Company
Summary of the Group Session on Applied Geography and Comments on training for Work in Business and Industry

Formal critics for the session:
John W. Alexander, University of Wisconsin
Edward B. Espenshade, Northwestern University
Hibberd V. B. Kline, Jr., Syracuse University
Clarence B. Odell, Denoyer-Geppert Company
David G. Osborn, The Kroger Company
Victor Roterus, Department of Commerce
Vincent M. Throop, Bureau of the Census

TUESDAY MORNING, APRIL 13

9:00 A.M. GENERAL SESSION—*Della Robbia Room*

PROBLEMS IN THE GEOGRAPHY OF THE UNITED STATES

KENNETH C. MCMURRY, University of Michigan, presiding
Arranged by the Program Committee

CHAUNCY D. HARRIS, University of Chicago
The Last Fifty Years and the Next
Formal critics:
Thomas R. Smith, University of Kansas
Alfred J. Wright, The Ohio State University

JOHN C. WEAVER, University of Minnesota
Isotope and Compound: A Framework for Agricultural Geography
Formal critics:
Nels A. Bengtson, University of Nebraska
Clarence F. Jones, Northwestern University

EDWARD L. ULLMAN, University of Washington
Geography as Spatial Interaction: Some American Examples
Formal critics:
John W. Alexander, University of Wisconsin
Raymond E. Murphy, Clark University

MERLE C. PRUNTY, JR., University of Georgia
Infusion and Renascence: Mechanization and the Southern Neo-Plantations
Formal critics:
Loyal Durand, Jr., University of Tennessee
John W. Morris, University of Oklahoma

TUESDAY AFTERNOON, APRIL 13

1:30 P.M. THREE CONCURRENT GROUP SESSIONS
1:30 P.M. FIELD TRIP: HISTORICAL PHILADELPHIA
4:30 P.M. TEA, THE GEOGRAPHICAL SOCIETY OF PHILADELPHLA

Session A—CLIMATOLOGY—*Alumni Auditorium, Dietrich Hall*
DOUGLAS H. K. LEE, The Johns Hopkins University, presiding
Arranged by the chairman

DOUGLAS H. K. LEE, The Johns Hopkins University
Dynamism in Climatology

HERBERT C. S. THOM, United States Weather Bureau
Analytical Foundations of Climatology

C. Warren Thornthwaite, The Johns Hopkins University
Topoclimatology

F. Kenneth Hare, McGill University
Synoptic and Dynamic Climatology

Formal critics for the session:

Werner A. Baum, Florida State University
George S. Benton, The Johns Hopkins University
Charles F. Brooks, Harvard University
James D. Hardy, University of Pennsylvania
Woodrow C. Jacobs, Air Weather Service

Session B—history of geography—*Room E-8, Dietrich Hall*

John K. Wright, American Geographical Society, presiding
Arranged by the chairman and David Lowenthal, Vassar College

Jan O. M. Broek, University of Minnesota
Friedrich Ratzel in Retrospect

John B. Leighly, University of California, Berkeley
What Has Happened to Physical Geography?
(To be read by the chairman)

C. O'D. Iselin, Woods Hole Oceanographic Institution
The History of Oceanographic Research

Clarence Glacken, University of California, Berkeley
The Idea of Progress and the Habitable World

Richard Hartshorne, University of Wisconsin
Kant, Humboldt, and Hettner on the Place of Geography Among the Sciences: An Attempt to Trace the History of an Idea

Formal critics for the session:

Stanley D. Dodge, University of Michigan
Robert S. Platt, University of Chicago
Norman J. G. Pounds, Indiana University

Session C—THE PAN AMERICAN INSTITUTE OF GEOGRAPHY AND HISTORY—PROGRAM ON THE GEOGRAPHY OF THE AMERICAS—*Ballantyne Auditorium, Dietrich Hall*

PRESTON E. JAMES, Syracuse University, presiding

Arranged and presented by the Committee on the Geography of the Americas, AAG: John H. Garland, University of Illinois, *Chairman;* Fred B. Kniffen, Louisiana State University; Merle C. Prunty, Jr., University of Georgia; John H. Thompson, Syracuse University

The above committee is charged with organizing and preparing for the PAIGH a detailed geography of the United States. This meeting is to consider the relation of the Committee to PAIGH, the organization of the work, maps and map scales, original data and how to get it, and procedures to be followed.

Field Trip—HISTORICAL PHILADELPHIA*

4:30 P.M. THE GEOGRAPHICAL SOCIETY OF PHILADELPHIA

The Geographical Society of Philadelphia cordially invites those attending the Fiftieth Anniversary meeting of the Association of American Geographers to be their guests at a Tea to be held at 4:30 P.M. in Dietrich Hall.

TUESDAY EVENING, APRIL 13

8:00 P.M. ANNUAL BUSINESS MEETING—*Della Robbia Room*

WEDNESDAY MORNING, APRIL 14

9:00 A.M. THREE CONCURRENT GROUP SESSIONS

Session A—LANDFORM DESCRIPTION FOR GEOGRAPHERS—*Room E-8, Dietrich Hall*

WALLACE W. ATWOOD, JR., National Academy of Sciences, presiding

Arranged by Arthur N. Strahler, Columbia University

LEONARD ZOBLER, Columbia University and Hunter College

A Statistically Validated Method for the Delimitation of Geographic Regions

Formal critic:

Harold H. McCarty, University of Iowa

* The excursion through Historical Philadelphia will cost $1.65 per person.

EDWIN H. HAMMOND, Universiy of Wisconsin

An Objective Approach to Terrain Description

Formal critic:

Guy-Harold Smith, The Ohio State University

LOUIS C. PELTIER, United States Geological Survey

Some Properties of the Average Topographic Slope

Formal critic:

Wesley C. Calef, University of Chicago

ARTHUR N. STRAHLER, Columbia University

Dimensional Analysis in Quantitative Terrain Descriptions

Formal critic: (to be announced)

RICHARD J. RUSSELL, Louisiana State University

Alluvial Morphology of Anatolian Rivers

Formal critic:

John E. Kesseli, University of California, Berkeley

H. T. U. SMITH, University of Kansas

Classification of Dune Areas for Geographical Purposes

Session B—THE GEOGRAPHY OF AMERICAN AGRICULTURE: FIFTY YEARS—*Ballantyne Auditorium, Dietrich Hall*

CLARENCE OLMSTEAD, University of Wisconsin, presiding
Arranged by the chairman

EDWARD HIGBEE, Clark University

Pioneer Remnants and Recent Trends in Northeastern Agriculture

Formal critics:

Henry Madison Kendall, Miami University
Karl J. Pelzer, Yale University

FRASER HART AND EUGENE MATHER, University of Georgia

Southern Agriculture: Thirty Years of Progress in the Last Half Century

Formal critics:

Loyal Durand, Jr., University of Tennessee
J. Sullivan Gibson, University of North Carolina

HAROLD H. MCCARTY, University of Iowa
Land-use Competition Between Wheat and Corn in the Middle West

Formal critics:

Leslie Hewes, University of Nebraska
John K. Rose, Washington, D. C.

PEVERIL MEIGS, III, Department of the Army
Fifty Years of Tides and Waves in Western Agriculture

Formal critics:

John M. Loeffler, University of Colorado
Richard F. Logan, University of California, Los Angeles

Summary Discussion:

Carleton J. Barnes, Department of Agriculture
Derwent Whittlesey, Harvard University

Session C—URBAN GEOGRAPHY—*Alumni Auditorium, Dietrich Hall*

ROBERT E. DICKINSON, Syracuse University, presiding
Arranged by the chairman

HOMER HOYT, Homer Hoyt Associates
Recent Developments in the Economic Base Concept of Urban Growth and the Sector Theory of Neighborhood Growth

Formal critics:

John W. Alexander, University of Wisconsin
Edward L. Ullman, University of Washington
W. L. C. Wheaton, University of Pennsylvania

ROBERT C. KLOVE, Bureau of the Census
Urban Population Trends and Our Future Metropolitan Cities

Formal critics:

Harlin G. Loomer, Philadelphia City Planning Commission
Raymond E. Murphy, Clark University

VICTOR ROTERUS, Department of Commerce
Industrial Location and Community Development in Metropolitan Areas

Formal critics:

Chauncy D. Harris, University of Chicago
Rita D. Kaunitz, United Nations Secretariat
Robert B. Mitchell, University of Pennsylvania

HAROLD M. MAYER, University of Chicago
Accessibility as a Measure of the Extent of Urban Nodality in the Chicago Region

Formal critics:

John E. Brush, Rutgers University
Allen K. Philbrick, University of Chicago

WEDNESDAY AFTERNOON, APRIL 14

1:30 P.M. THREE CONCURRENT GROUP SESSIONS

Session A—THEORY IN ECONOMIC GEOGRAPHY—*Alumni Auditorium, Dietrich Hall*

ROBERT S. PLATT, University of Chicago, presiding
Arranged by Walter Isard, Massachusetts Institute of Technology

WALTER ISARD, Massachusetts Institute of Technology
Theoretical Approaches to Spatial Analysis

EUGENE SCHOOLER, Massachusetts Institute of Technology
Substiution Analysis and the Location of the Petrochemical Industry

ROBERT E. KUENNE, Harvard University
Input-Output Analysis and the Impact of the Fairless Steelworks on the Delaware Valley

HOWARD L. GREEN, Stop and Shop, Incorporated
Gravity Models and Supermarket Trading Areas

Formal critics for the session:

Thomas R. Smith, University of Kansas
Edward L. Ullman, University of Washington

Session B—CULTURAL GEOGRAPHY—*Ballantyne Auditorium, Dietrich Hall*

ALFRED H. MEYER, Valparaiso University, presiding
Arranged by the chairman

WILBUR ZELINSKY, University of Wisconsin
Generic Terms in the Place-Names of the Northeastern United States: An Approach to the Demarcation of Culture Areas

Formal critics:

Meredith F. Burrill, Department of the Interior
Hallock F. Raup, Kent State University

GEORGE W. HOFFMAN, University of Texas
A Changing Cultural Landscape in the Middle Upper Inn Valley (Tirol, Austria)

Formal critic:

Robert C. West, Louisiana State University

NORMAN J. G. POUNDS, Indiana University
A Study of Agriculture in a Part of the Paris Basin in the 9th Century A.D.: Looking Back to the Origins of this System and Forward to the Agriculture of the Present

GEORGE KISH, University of Michigan
The Pontine Marshes: Cultural Change Through Inner Colonization

Formal critics:

John Augelli, University of Maryland
Robert E. Dickinson, Syracuse University

Session C—THE TRANS-ROCKY WEST: PEOPLE AND WATER—*Room E-8, Dietrich Hall*
ROBERT M. GLENDINNING, University of California, Los Angeles, presiding
Arranged by the chairman

HOWARD J. NELSON, University of California, Los Angeles
Urbanization in the Trans-Rocky West

Formal critics:

William L. Garrison, University of Washington
Rhoads Murphey, University of Washington

WESLEY C. CALEF, University of Chicago
Integration of the Use of Irrigated and Non-Irrigated Land in the Intermont West

Formal critics:

Charles M. Davis, University of Michigan
Elbert E. Miller, University of Utah

MARTIN R. HUBERTY, University of California, Los Angeles (College of Agriculture)
Water Problems of the Trans-Rocky West

Formal critics:

Meredith F. Burrill, Department of the Interior
Marion E. Marts, University of Washington

Note: A paper on the agriculture of the Trans-Rocky West is included in Session B, Wednesday Morning.

WEDNESDAY EVENING, APRIL 14

7:30 P.M. BANQUET—*Ballroom, Penn-Sherwood Hotel*
JOSEPH A. RUSSELL, retiring Vice President, presiding

PRESIDENTIAL ADDRESS

J. RUSSELL WHITAKER, The George Peabody College for Teachers
The Way Lies Open

THURSDAY, APRIL 15

Thursday morning ALL DAY FIELD TRIP (See General Information for details)

ANNALS of the
Association of American Geographers

Volume XLIV MARCH, 1954 Number 1

ROAD AND RAIL IN THE CENTRAL MASSIF OF FRANCE

JAMES BIRD
University of Southampton

WHEN the scheme of morphological subdivision propounded by N. Fenneman is applied to Western Europe, the Central Massif of France appears as a physiographic province with a unity of major relief type and structural evolution.[1] The geographical regions within this province have two other important features in common: they have a similar history, and the majority are characterized by a "mountainous centrality" with regard to the rest of France. It is the purpose of this paper to examine the emergence of the general patterns of road and rail communications in these regions, and, subsequently, to analyze their relations with the position of the Massif, the relief, and the various regional economies.

EMERGENCE OF THE MAIN ROAD PATTERN

The width, surface, and direction of any route is greatly influenced by the transport unit which moves along it; indeed, the word "route" includes the thought of the vehicle as well as the prepared way. In the Massif at a period before the breakdown of the self-sufficient regional economies, the most used vehicle was the mule. During the early eighteenth century, though each region was largely self-sufficient, there were a few inter-regional exchanges of such goods as: agricultural exports from the Massif; fish and salt from the coasts; wool from Spain; and wines, soaps, spices, and textiles from the Mediterranean lands. These were transported on the backs of mules, and the tracks they followed were narrow, in fact wide enough only for one or two animals and their driver. Difficulties of steep gradients were often ignored in favor of short, direct routes. Since mules are good climbers the tracks could make awe-inspiring ascents of the Causse of Larzac, the Cévennes, the Chain of Puys, and elsewhere to reach the interior plateaus. Thus the routes of the mule-traders tended to coincide with the straight-aiming Roman military roads, and, as P. Mamet has said, "The Middle Ages travelled upon the débris of the Roman roads."[2] Within the Massif the roads generally followed the crests and plateaus.

[1] D. L. Linton, "The Delimitation of Morphological Regions," *London Essays in Geography*, edited by L. D. Stamp and S. W. Wooldridge. London: Longmans, 1951. p. 199, see diagram p. 206.

[2] P. Mamet, "Du Nord au Midi par le Massif Central au cours de vingt siècles," *Almanach de Brioude*, 1935, p. 125.

Here the ground is firmer and more quickly drained after summer storms and was less obstructed by forests; in those dangerous days open spaces reduced the likelihood of ambush. The gorges were avoided as much as possible. A special example of crest routes was the military roads of the Cévennes, constructed to deal with Protestant uprisings (1668 et seq.).

However, during the eighteenth century, the national road network of *grandes routes,* forerunners of the *routes nationales,* took shape as the central government began to realize that national security and economic advancement depended closely upon the state of the internal communications. (The *Corps des Ponts et Chaussées* was instituted in 1716.) Since the Massif was economically backward and is remote from frontiers, road development stagnated, and at the end of the eighteenth century the national roads by-passed it, except for two north-south routes, the descendants of the Roman *Via Regordana* (Fig. 1). The trunk roads, constructed by the State, contrasted greatly with the local roads, which remained unimproved.[3] The latter were not officially considered until an Act in 1836, and the contrast between the excellently surfaced *routes nationales,* plunging determinedly across the countryside, and the cart-track side-roads has only been reduced during recent years.

ORIGINS OF THE TRUNK RAIL PATTERN

Mining engineers took the initiative in the railway development of France. The country's first railway, operated by horse traction, was laid in the Massif in 1827, to export coal from St Étienne to the Loire, at Andrézieux. By 1833 St Étienne was linked by locomotive with Lyons and Roanne.[4] However, the national design of French railways is the result of the Act of 1842, which established the pattern radiating from Paris, in close correspondence with the *grandes routes* of a century earlier. In addition, this Act inaugurated national rail development by associating the State with certain statutory rail companies. The State undertook to acquire the lands, two-thirds of which were contributed by the interested communes, and to carry out the building of the infrastructure and the necessary tunnels and bridges. After 1883 it was agreed that this subsidy should be increased where construction of lines was unusually difficult. This action by the State had important repercussions upon the trunk rail pattern of the Massif. The companies, on the other hand, were to provide all the superstructure and rolling-stock, and to retain the whole upon long leases. This arrangement, with minor modifications, operated until nationalisation in 1937.

At first, the railways of the Massif, and their further development, fell to the charge of the *Grand Central* Company, inaugurated in 1853. Unfortunately, this

[3] "This order [of construction] was defined by the *Instruction* of June 13, 1738, which prescribed that the trunk roads should be built and repaired before any transverse roads were undertaken, and gave priority to the main roads leaving Paris for the provincial cities, seaports, and frontiers of the kingdom . . . the post roads." H. Cavaillès, *La route française, son histoire, sa fonction.* Paris: Colin, 1946. p. 72.

[4] H. Peyret, *Histoire des chemis de fer en France et dans le monde.* Paris: Société d'Éditions Françaises et Internationales, 1949. p. 188.

company's area embraced only difficult mountainous country; its main line, which was a diagonal trunk line to the south-west, via Clermont-Ferrand and Aurillac, was hopelessly uneconomic compared with the Paris-Limoges-Toulouse line; its network was unintegrated; there was no access to the sea or to Paris; and it had no extensive industrial area to serve. Therefore it is not surprising that the *Grand Central* was dissolved after only four years' existence, and its network passed to the *P.-O.* (*Paris-Orléans*) and the *P.-L.-M.* (formerly the *Paris-Lyon*) companies.[5]

EFFECTS OF THE POSITION OF THE MASSIF

Figures 1 and 2 show striking similarities in the general patterns of road and rail in the Central Massif, namely: the two north-south routes; the route to the southwest from Clermont-Ferrand across Auvergne; the east-west communications between Lyons and Limoges; the absence of diagonal routes; and the tendency for the main routes to encircle the Massif, except where they cut across the Limousin plateaus, via Limoges. These recurring general patterns are largely the result of the position of the Massif, which certainly makes it a barrier for diagonal routes across France, as from Toulouse to Lyons and from Limoges to Marseilles. However, in the basic national plans, both for road and for rail, diagonal routes were never included. The networks were centered on Paris, and the Massif can be skirted rather easily when travelling from the capital to the southeast and southwest. Yet in the Plain of Languedoc there is an area which is cut off from direct access to Paris by the bulk of the Massif; a north-south route across the upland was therefore always desirable. It was difficult to decide such a route's actual location. Eventually two main roads were constructed in the eighteenth century: one via Brioude, Le Puy, and Alès; the other via St Flour and Millau. In the east-west direction a route was always needed to effect exchanges between the primarily agricultural areas of Limousin and Auvergne, and the industrial regions of St Étienne and Lyons.

These same positional factors operated in the construction of the trunk railways, but with added force. With improved communications reciprocal exchanges became more important upon the routes between Limoges and Lyons; and the wine traffic from the Plain of Languedoc became increasingly lucrative as an enormous market developed in Paris and the north. There was intense rivalry for this traffic between the *P.-O.*, the *Paris-Midi,* and the *P.-L.-M.* companies.[6] An agreement between the companies was made in 1863. Article II of this agreement stated that the company operating the shortest railway line between two terminals[7] should have the exclusive right to the traffic of the terminal areas; and Article V declared that the company operating this rail line of "shortest distance" was to be indemnified

[5] A. Trin, *Les chemins de fer cantaliens.* Aurillac: Imprimerie Moderne, 1942. p. 5.

[6] R. Caralp, "Le transport ferroviaire des vins languedociens vers Paris," *Revue de Géographie de Lyon,* XXVI, No. 3 (1951): 273.

[7] This principle of the "shortest distance" is in contrast to "virtual distance" in which the time factor (dependent on gradients, radii of curves, number of tracks, etc.) is taken into account.

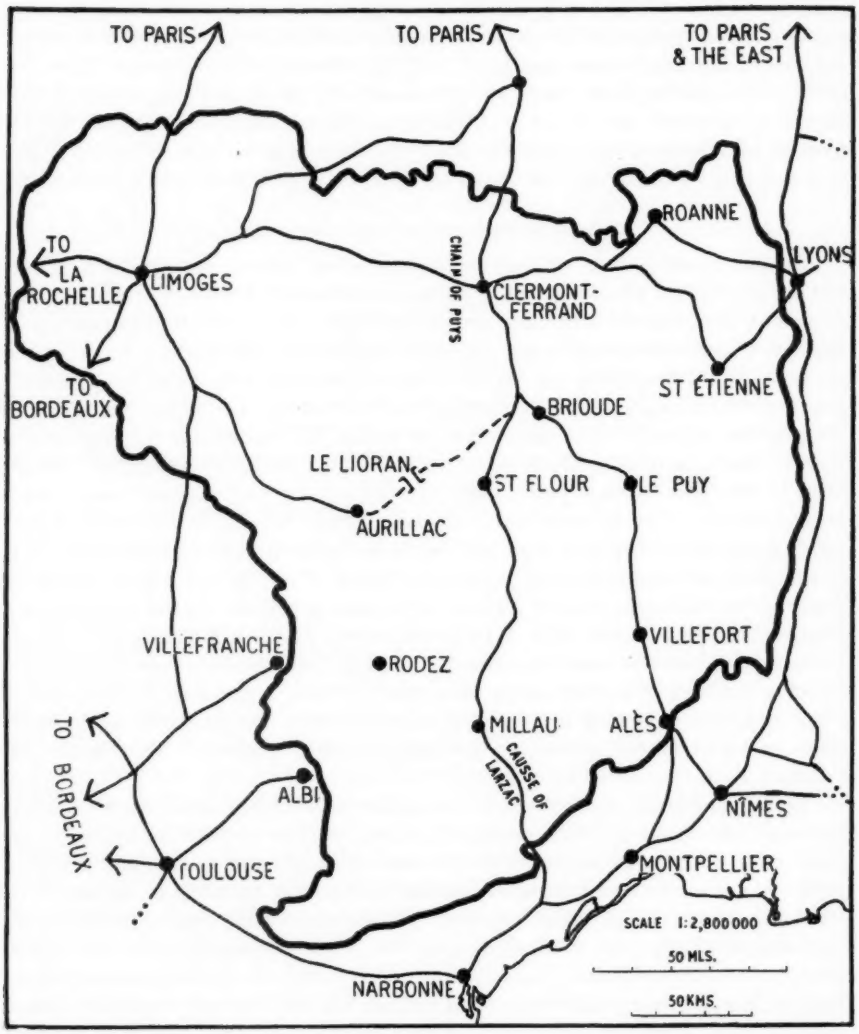

FIG. 1. Post roads at the end of the eighteenth century (after Desauches's map, 1797, from P. Vidal de la Blache, *Tableau de la géographie de la France.* Paris: Hachette 1911. p. 379). The road from Brioude to Nîmes, via Le Puy, was completed by the end of the century. A. Leroux, *Le Massif central, histoire d'une région de la France,* II, Chap. XIII, "Voies et moyens de communication." Paris: Bouillon, 1898. p. 184. The road from Clermont-Ferrand to Aurillac was not finally finished in the form shown until 1849, when engineering technique enabled a tunnel to be driven beneath the pass of Le Lioran.

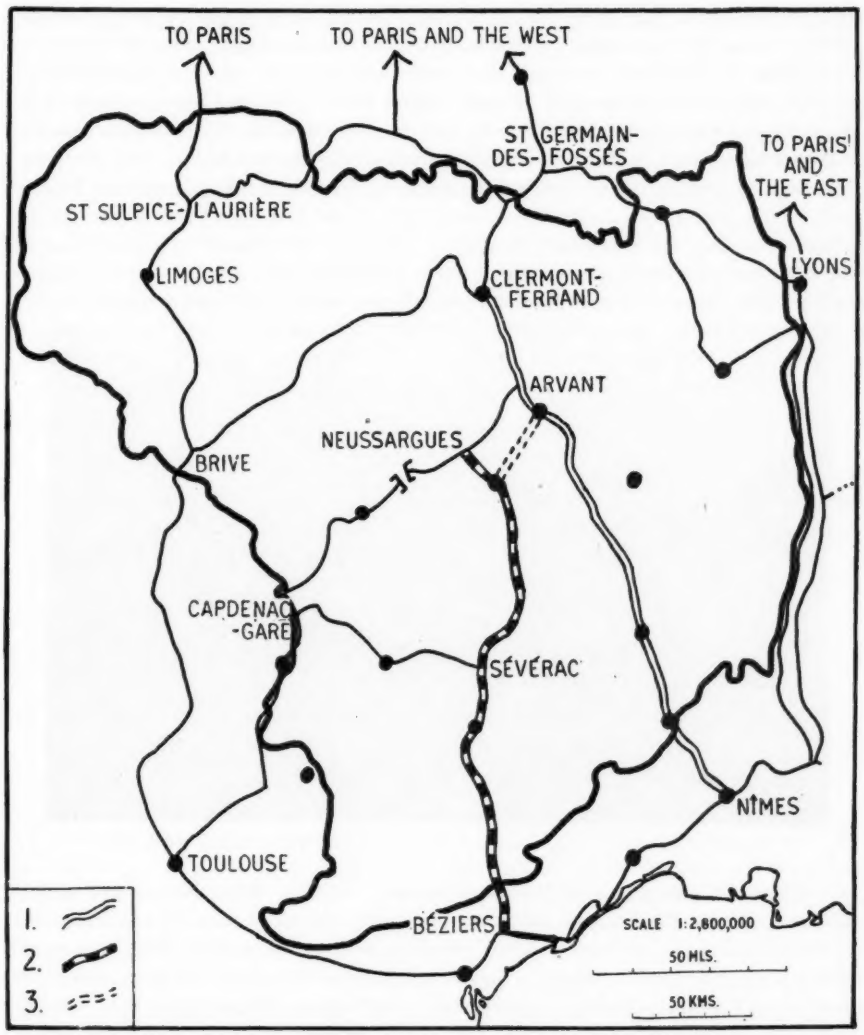

FIG. 2. Trunk railways of the Central Massif. 1, 2, 3. Lines constructed with the aim of obtaining the "shortest distance" between Paris and the Plain of Languedoc. 2. Line electrified since 1932. 3. Line now abandoned. The most important rail junctions are named. It may be noticed that the majority of these are on the periphery of the Massif; for though the Massif can be skirted, the centrality of its position forces trunk lines close to its borders.

should this traffic, for some reason, be transported by a longer route across the system of another company. At this time the shortest route from the Plain of Languedoc to Paris was via the *P.-O.* system, but the *P.-L.-M.* was pushing ahead with its direct Paris-Clermont-Ferrand-Nîmes line. The enormous difficulties in the gorges of the upper Allier (Fig. 3) and the descent of the Cévennes entailed the construction of no less than 101 tunnels between Brioude and Alès.[8] The company was compensated by the prospect of obtaining most of the traffic of southern France and by the state subsidies for the construction of the line, as set out in the Act of 1842. The line was completed in 1870. The *P.-L.-M.* thereby captured most of the Languedoc wine exports, which were promptly sent around by the Rhône valley route, since the easier gradients and curves made this more economical.

FIG. 3. The upper Allier gorges, wherein runs the Paris-Nîmes trunk line.

Meanwhile, the *Paris-Midi* was proceeding with its direct line of crenellated profile between Béziers and Neussargues, with the chief aim of obtaining the "shortest distance" to Paris. This incredible line, completed in 1880, crosses no fewer than four major gorges by means of, respectively from north to south, the viaduct of Garabit over the Truyère; and gradients of 30 per mil (Lot), 33 per mil (Aveyron), and 33 per mil (Tarn). A further gradient of 33 per mil is needed to reach the Plain of Languedoc. This contrasts greatly with the maximum gradient on the Rhône valley route which is 8 per mil. Other lines were conceived with the idea of gaining this "shortest distance," though most of the traffic would be diverted around the Massif, as it still is today,[9] by a longer yet more eco-

[8] H. Lartilleux, *Géographie des chemins de fer français*, Vol. I, *La S. N. C. F., Tome* I of *Géographie universelle des transports.*. Paris: Chaix, 1946. p. 297.

[9] R. Caralp, "L'évolution de l'exploitation ferroviaire en France," *Annales de Géographie*, LIX (1951): 326.

nomically operated route. This amazing state of affairs was encouraged by the government subsidies available for the construction of lines in difficult country. The results appear on the map today as the Paris-Clermont-Ferrand-Nîmes line, and the Paris-Clermont-Ferrand-Neussargues-Béziers line. These reproduce the pattern of the two north-south roads, because of the determination to build lines over the "shortest distance," even at the expense of adding great difficulties to their construction and of ignoring entirely the economy of regions through which they were originally driven.

Though the Massif has continued to present great difficulties to the construction of diagonal routes across France, the northeast to southwest road and railway were finally completed. However, *Route Nationale* No. 88, from Lyons to Toulouse, is primarily a tourist road, and an *autorail,* following a zigzagging course, upon many branch lines, only runs in the summer months, taking urban dwellers up into the mountains, and requires twelve hours for the complete journey.

EFFECTS OF RELIEF

Having examined the forces which have brought about the general patterns of the main through communications, the regional patterns will next be examined.

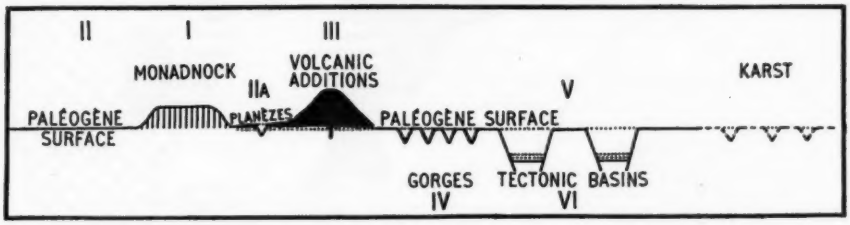

FIG. 4. Schematic diagram showing the chief modifications of the major relief type (the *paléogène* surface) of the Central Massif.

Within the Massif, relief is an important factor in the location of road and rail. The "major relief type" which characterizes the Central Massif is the plateau surface called the *paléogène* (early Tertiary) by French geomorphologists. However, there are two more important relief types above this surface and two below it. To this simplified conception must be added the limestone plateaus and gorges of the Causses, caught up in the general uplift of the Massif; they continue the basic plateau and gorge association as a coincidental result of their particular stage in the karstic cycle. Figure 4 shows this idea in a schematic section, and Figure 5 classifies the regions of the Massif according to the predominance of these landform types.

I. The only large monadnock area of the Massif, *"La Montagne"* (the Plateau of Millevaches), is a miniature Central Massif surrounded by the *paléogène* plateau of Limousin. As is the case with its larger analogue, through communications are driven across it, but there is no network, and the junctions are on the periphery.

II. A more frequent landform is a peneplaned (*paléogène*) granite surface, slashed by the gorges of rejuvenated rivers. Where basalt has flowed across this

surface, as in the *planèzes* of St. Flour and Western Velay, similar plateau and gorge landforms are found (Figs. 4 and 5, Category IIa, see also Fig. 6). In these areas construction of communications faces a dilemma. If the routes follow the gorges, they are condemned to winding, rugged, and narrow courses, often ending in an impasse at a knick-point, and sunk down, dark and deserted, far away from the habitations on the plateau above (Fig. 3). If the plateau is chosen, it is true

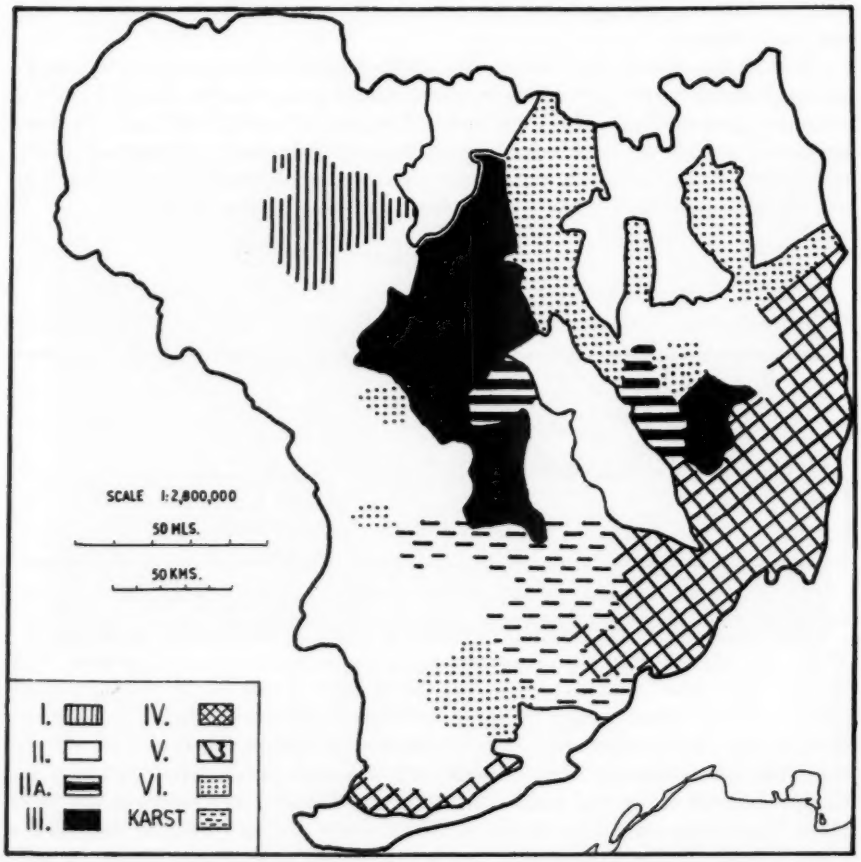

FIG. 5. Landform types of the Central Massif. This diagram was drawn by classifying the regions of the Central Massif according to the predominance of one of the landform types illustrated in the section in Figure 4. Most of these regions are named in Figure 9. For more detailed schematic diagrams of the landforms of the Central Massif, see E. de Martonne, *France, physique, Géographie universelle,* VI, Part One (Paris: Colin, 1947), Fig. 40, p. 109; and the *Atlas de France, Morphologie,* Sheets 9 and 9a. Regions after *Les régions géographiques de la France* (Paris: Presses Universitaires, 1947), a publication of the *Institut National de la Statistique et des Études Économiques.*

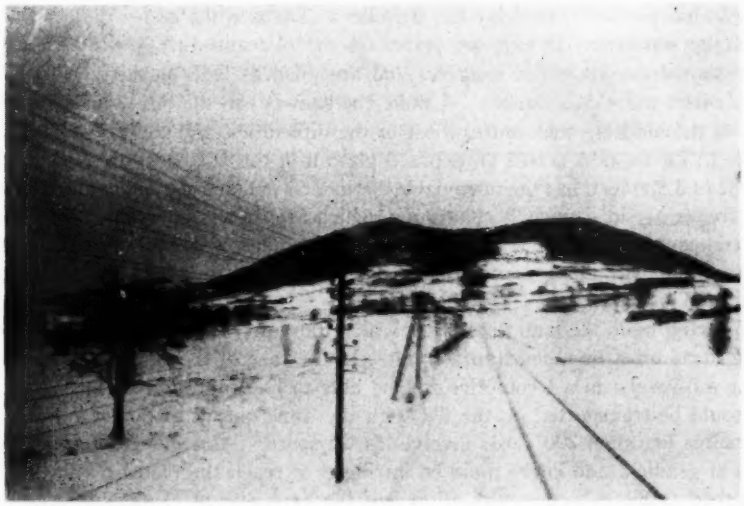

FIG. 6. On the northwestern plateau of Velay. This is a view of a branch line upon a *planèze*, 13 miles north-west of Le Puy.

that the population may be better served, but there are the gorges to cross. This results in expensive structures for the railway: such as the viaducts at Tanus, (378 feet above the river Viaur, between Albi and Rodez); at Garabit (402 feet above the river Truyère); and at Fades (Fig. 7). In the case of the road there are

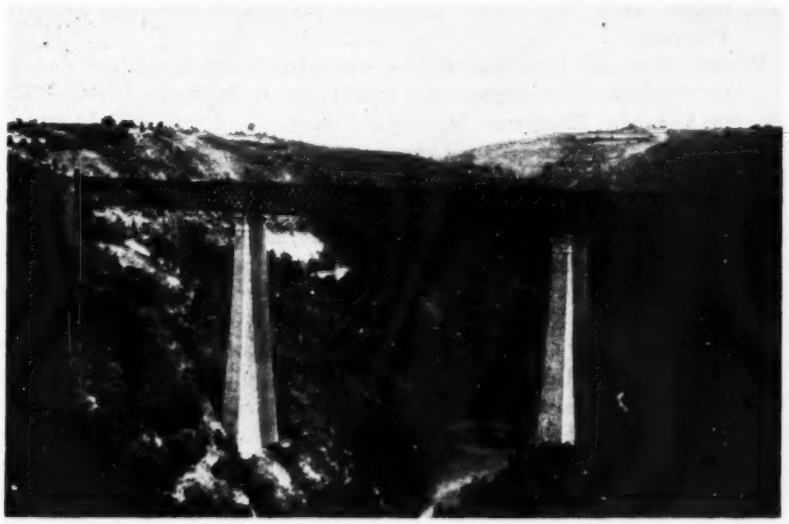

FIG. 7. The viaduct of Fades, 433 feet above the river Sioule, between Clermont-Ferrand and Montluçon.

tiresome hairpin bends to delay the traveller. There is the added danger of being cut off by snowdrifts in exposed places on the plateaus during winter (Fig. 6). These snowdrifts are called *congères* and are piled as high as thirty feet in those places where the winds slacken. Unlike the snowfall in the Alps, it is the irregularity of the blocking that causes most of the difficulties, and the railway line from Mende to La Bastide, across an exposed plateau of the northeastern Causses, at an altitude of 3,500 feet, has the unenviable distinction of being the line which is blocked most frequently in France.[10] *Autorails,* which are diesel-driven coaches, economically compact for local rail traffic, have the disadvantage of not being massive enough to force their way along a snow-covered track, and steam trains often have to be substituted in winter.

In seeing upon the map the way in which these problems have been met the following facts must be taken into account. In the case of the railway, a gradient of 25 per mil results in a locomotive's being able to haul only one-eighth of the load that could be transported on the flat with the same output of power,[11] and curves of a radius less than 200 yards involve loss of speed. As a general rule both these limits of gradient and curve must be infringed to reach the plateau. On the other hand road traffic can cope with all except the most abrupt changes of level, aided by the modern zigzagging highway. The results of this are that the railway follows the valleys wherever possible, and the roads follow the population; and since the population is generally found upon the plateaus the roads are largely crest routes.[12]

The most difficult regions for communications come within the next three categories:

III. high volcanic areas (volcanic Auvergne, south-eastern Velay);

IV. regions where rejuvenated gorges are particularly numerous (Cévennes, Vivarais);

V. narrow granitic horst-like regions, where the *paléogene* surface is abruptly upraised relative to neighbouring areas (Combraille, Monts du Forez, Monts du Lyonnais, Margeride, Montagne Noire).

In these regions it is fortunate if the general direction of the routes is parallel to the main river valleys; but routes which lie transverse to the gorges are condemned to the greatest detours and difficulties. As seen upon the map, the railway loops are characteristically of a greater and more graceful wavelength than the concertina-like bends of the road, which alternate with straighter portions on interfluves (Fig. 8). Wherever possible in the higher glaciated regions of Auvergne road and rail follow the valleys. For trunk roads to be sited in the valleys is exceptional, but then, in the Central Massif as a whole, such glaciated landforms are equally exceptional.

VI. In the tectonic basins road and rail are less fettered, but only the tectonic basin of the *Grande Limagne* is large enough to give rise to a network, based on Clermont-Ferrand.

[10] R. Caralp, "Les chutes de neige de l'hiver 1950–1, et les communications en France," *L'Information Géographique* (July–Oct. 1951): 154.

[11] Caralp, "L'évolution de l'exploitation ferroviaire en France," *loc. cit.*, p. 324.

[12] The industrial region of St Étienne, crowded within a series of narrow valleys, is rather exceptional, and the roads must quit the plateaus to serve it.

This control exerted by relief has other inconveniences. Often railway stations are far from the towns and villages whose name they bear, and which may be hundreds of feet above on the plateau; a striking example of this is the station of Rodez, a little over a mile to the north of the city and 370 feet below it. Another difficulty resulting from the siting of railways in deep valleys is the difficulty of establishing

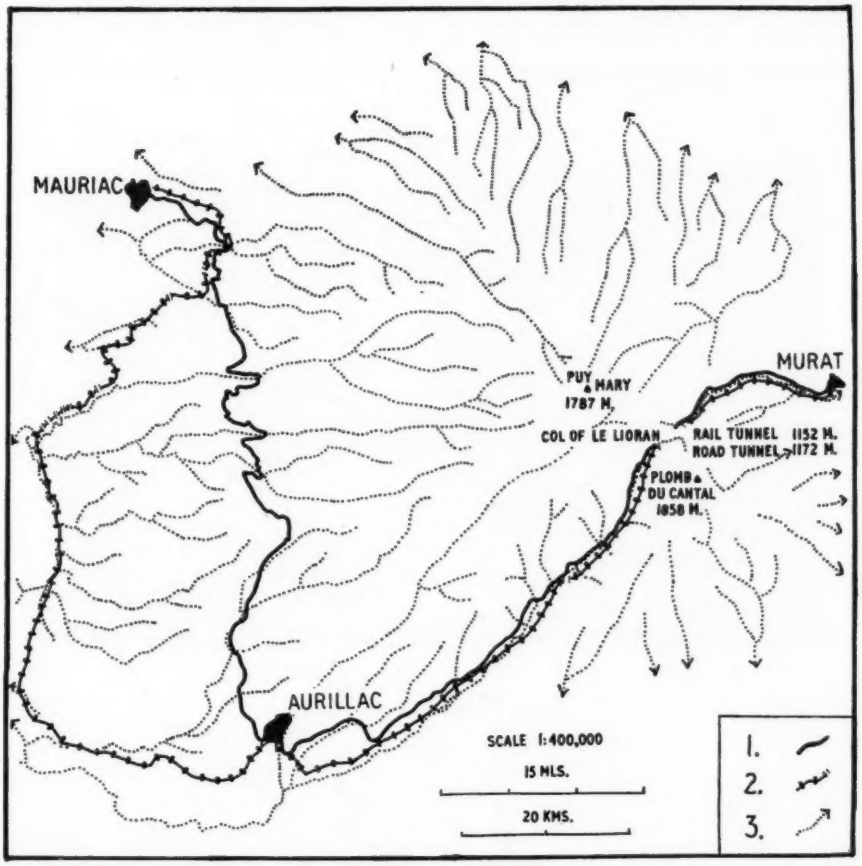

FIG. 8. Road and rail patterns parallel and transverse to the drainage in Cantal (Volcanic Auvergne). 1. Road. 2. Rail. 3. Streams in deep, glacially modified valleys. For location of Le Lioran see Figure 1.

junctions. Within the Massif there are a few junctions which give rise to towns dependent on the railway, as at Arvant, Neussargues, Capdenac-Gare, and St. Sulpice-Laurière, but all the really important nodes are upon the periphery (Fig. 2). The difficulties of relief are also the reason for the fact that the pattern of national roads largely ignores the little secondary towns and villages upon the plateaus; for,

once on the flat surface after a tortuous climb, the main road must link the chief settlements in the most direct manner possible, if it is not to be unduly lengthened.

COMMUNICATIONS AND THE REGIONAL ECONOMIES

To illustrate the effect of the various regional economies upon the density of communications Figure 9, based on data drawn from bus timetables, shows the chief bus centers and subsidiary junctions in the Massif. Since about 1922 these bus

FIG. 9. Chief bus centers of the Central Massif. 1. Centers with 20 or more local bus routes. 2. Centers with 7–19 local bus routes. 3. Centers with 4–6 local bus routes. Narrow granitic horst-like regions (where the *paléogène* surface is abruptly upraised relative to neighboring areas) are bounded with a thicker line. It may be assumed that the frequency of services to a bus center is directly proportional to the number of bus routes that radiate from it. Regional boundaries after *Les régions géographiques de la France, op. cit.*, see Figure 5.

services, together with fleets of small lorries, have been the chief transporting agents of the agricultural economy of the Massif. With ease they carry the farmer and his produce from home to market (Fig. 10), at a time exactly attuned to his needs, and with the minimum of transhipment. By these same vehicles the much-needed products of the town are quickly disseminated over the surrounding countryside to a radius of approximately 20-30 miles. The great improvement in the agricultural economy of the Ségala[13] region, through the cheap distribution of lime, is a notable example of the effects of this organisation of road transport. The route patterns are spoke-shaped; for the urban centers are at relatively low elevations, and away from these hubs of activity, as altitude increases, the economy becomes progressively less intensive, the population more scattered, and the transport services correspond-

FIG. 10. A typical local bus service, with a fixed route, functioning on market-days and Saturdays. The bus originates from the village and not from the regional center of Le Puy.

ingly more desultory. Therefore, while the comfort and speed of the train and the *autorail* may be sought for the longer journeys, it is only rarely that their inflexible tracks serve the day-to-day needs of the farming population. Road and rail services are therefore more complementary than competitive in the Central Massif.

Unlike transport services in Great Britain, each bus has a fixed route, and its base is the hamlet or village, not the regional center (Fig. 10). Bus stations are unknown, except that Limoges uses a former meat market as a road goods center, and Clermont-Ferrand is planning to convert part of one of its main squares into a bus station. Yet there is generally little congestion in these larger centers, and a by-pass is not really necessary, since the ever-present circular boulevard, constructed on the former ramparts, acts as a natural diverter. Indeed, incoming traffic is

[13] The "land of rye" (*seigle*) on formerly unfertilised acid soils.

invited into the town center by the recurring legend, *"Centre Ville et Toutes Directions."* Bus "termini" are usually merely cafés on the ring boulevard.

Figure 9 also shows the paucity of bus services in the southern and southeastern regions of the Massif. In the Causses, where the communications are not so difficult parallel to the major valleys, the exclusively pastoral nature of the economy, and, above all, the low density of population reduce the intensity of road traffic. In the *Grande Limagne*, on the other hand, the richness of the agriculture allied to important industries makes Clermont-Ferrand the most important bus center in the Massif, with a galaxy of subsidiary centers.

It would be facile arguing to suggest that improved communications inaugurated the depopulation of the Massif, which had begun, in most regions, long before the coming of the railway. This problem is best attacked from the standpoints of rural *over*-population in the nineteenth century, and the influx from more advanced regions of new ideas and of news of opportunities for more rapid self-advancement. This has occurred especially during and after wars with their consequent enforced migrations. In all this road and rail have played their part more as catalysts than stimuli.

CONCLUSION

When studying the map of the trunk communications of France, the Central Massif appears to live up to the expressive description of Élie de Beaumont—a *pôle répulsif*.[14] There is certainly no interior capital city. Nevertheless, it has been shown that outside influences are powerful enough to have driven north-south roads and railways right across, in spite of the difficult country, even when they must run transverse to the gorges.

Within the Massif the secondary road network focuses on several regional centers, to which are attracted the animal products of the Massif for export to the surrounding lowlands. It has been observed that in the majority of the regions there are rejuvenated rivers in deep gorges dissecting uplands of subdued relief. Yet road transport is flexible enough to follow the settlement, be this scattered over the plateaus, as is the general rule, or concentrated in the valleys, as around St Étienne and in the high glaciated regions of Auvergne. On the other hand, in all regions, the locomotive doggedly follows the confined valleys and gorges as far as possible, until, finally, wearily, it has to emerge, *force majeure*, on to the broad plateaus.

[14] The same idea is expressed a little differently by P. Vidal de la Blache. Towards the end of a chapter entitled, "L'ensemble du Massif Central," he writes, "Centrifugal force decidedly prevails." *Tableau de la géographie de la France.* Paris: Hachette, 1911. p. 283.

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THE SURFACE WATER SUPPLY OF AMERICAN MUNICIPALITIES*

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THE water which United States municipalities take from lakes, streams, and reservoirs in an average year constitutes about six per cent of the total withdrawal use of water in the nation for all purposes. It is approximately eleven per cent of the total withdrawal for public and private-industrial water systems in the nation's urban areas.[1] Surface-supplied municipal systems serve nearly two thousand communities with approximately one-half the population of the United States.[2] And these surface supplies are highly susceptible to problems created by pollution, sedimentation, and seasonal fluctuations of climate. Thus the following analysis deals with an important aspect of the United States water supply, although it is only one of several major interrelated parts of the total problem. It is hoped that this study will help to define the geographical limits of some of the generalizations which have been made from isolated water supply problems in various parts of the country.

THE LOCATION OF SURFACE-SUPPLIED MUNICIPAL SYSTEMS

City and county governments which can be directly concerned with problems of municipal supplies of surface water are confined mainly to parts of thirty-three states in the Appalachians, the southern mid-West and mid-continent areas, the Rocky Mountains, and along the Pacific coast (Fig. 1). Within most of the states, different sections vary widely in the proportion of their cities which use surface water. A few notable examples occur in the Carolinas, Georgia, Alabama, Texas, Oklahoma, Kansas, and Illinois.

Most of the large cities of the country appear on the map, Figure 1. They use surface supplies because of the high rate at which they require water. Among the thirty-nine cities of over 250,000 population in 1950, only three—Houston, Memphis, and San Antonio—depend upon wells alone.[3] Of the 106 cities with more than 100,000 inhabitans, only 16 do not appear on Figure 1; nine of those are on the Gulf Coastal Plain, and the rest are scattered widely about the country.

But Figure 1 does not have simply the pattern of large cities. It includes over 450 cities in the 10,000–100,000 class and nearly 1400 places of 1,000 to 10,000

*This study was made possible in part by a grant from the Graduate School, University of Minnesota.

[1] From data in Kenneth A. MacKichan, *Estimated Water Use in the United States—1950*, U. S. Geological Survey Circular 115, May, 1951. "Withdrawal use" here applies to all water used for domestic purposes, stockwatering, manufacturing, and irrigation.

[2] From data in *Inventory of Water and Sewage Facilities in the United States*, U. S. Public Health Service, 1948.

[3] Houston has completed a reservoir to supplement its ground-water supply with surface water from the San Jacinto River.

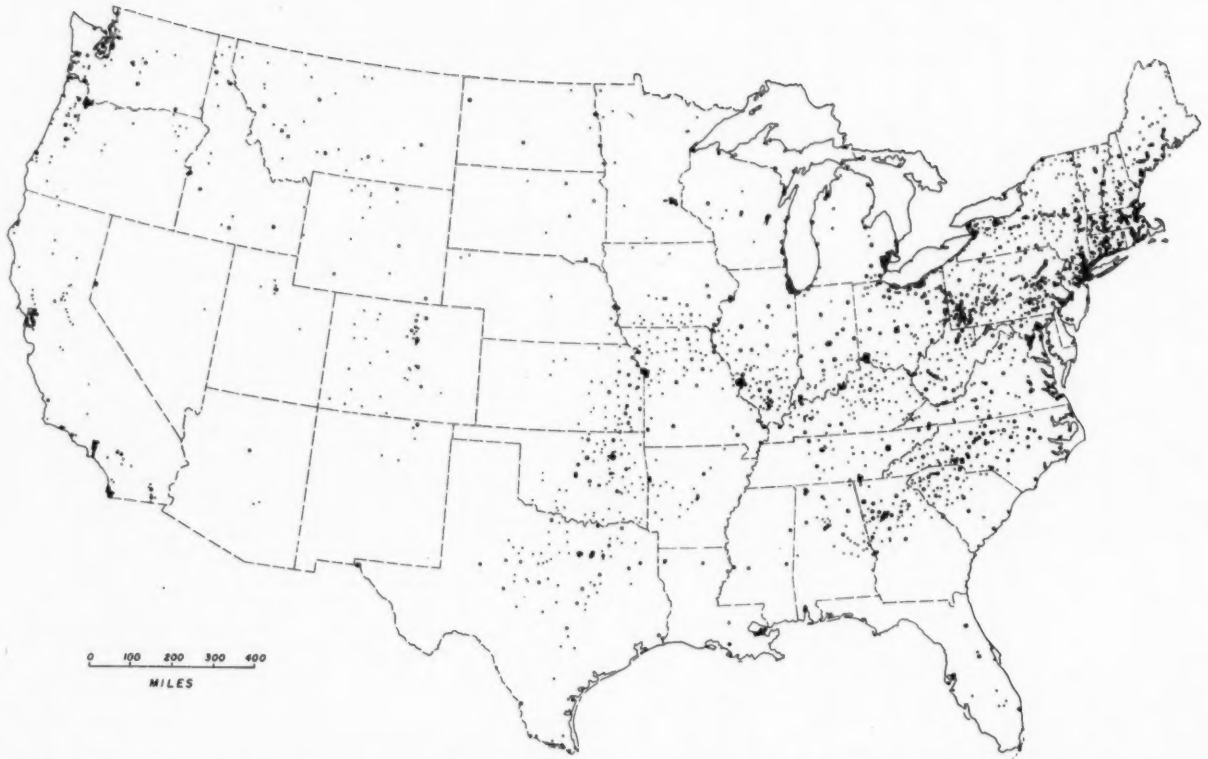

FIG. 1. Distribution of cities whose municipal water supplies are pumped from a lake, stream, or impounding reservoir. A few cities shown draw a part of their supply from subsurface sources; and systems using infiltration galleries along or beneath surface streams are included. Small dot symbols indicate cities in the 1000–10,000 population class; large dots, 10,000–100,000; cities shown to scale, over 100,000. Data from *Inventory of Water and Sewage Facilities in the United States, 1945*, Federal Security Agency, U. S. Public Health Service, Cincinnati, 1948.

population. The latter group of towns are using a surface supply even though their requirements are not large and the supply often needs heavy treatment. Nearly half of the American city people supplied from surface water sources are in municipalities of less than 100,000 population. And over two thirds of the surface-supplied public water systems are in communities of less than 10,000 people. Down to a population level around 100,000—with a few major exceptions—the geographic pattern of surface-supplied water systems correlates closely with the pattern of cities. In smaller population classes most places have to use surface water in some regions; in other regions, most places avoid using it. Thus the problems associated with the use of surface water are not primarily characteristic of large cities, and they are not equally likely in all parts of the country.

Location in the Pattern of Ground Water Availability

There are four areal concentrations of cities using surface water supplies in areas where ground water supplies are poor (Fig. 2).[4] In the Appalachian upland region there is a major use of surface water supply in areas of tightly-folded and faulted sedimentaries or of dense crystalline rock in New England, much of New York and northern New Jersey, and in the Blue Ridge and Piedmont provinces. There is also major use of surface sources in parts of the Appalachian "plateaus" and in some belts of the ridge-and-valley province. In those areas there is often much shale in the underlying Carboniferous rocks, with much salt water and few high-yielding aquifers.[5]

The belt of cities through the Ohio-central Mississippi-lower Missouri basins and southward through the mid-continent region is underlain generally by Paleozoic formations—mainly Carboniferous—which contain large amounts of shale and tight limestone. Where there is overlying glacial drift, it is thin and relatively high in clay.[6] These conditions produce low recharge and low rates of yield of ground water. In addition to these widespread ground water problems, excessive salinity is associated with Silurian formations underlying many of the cities of southeastern Michigan. In parts of western Kentucky, cavernous limestones produce very rapid subsurface drainage and, hence, a highly variable ground water supply. Locally in the mid-continent area cities are underlain by aquifers which have been contaminated by saline water from deeper formations through oil wells.[7]

The concentration of surface-supplied cities in the northern Great Plains of Montana and the Dakotas is less dense because of the relatively small urban devel-

[4] Explanations of these poor ground water conditions are summarized from *Geologic Map of the United States,* U. S. Geol. Survey, 1932; *Tectonic Map of the United States,* American Association of Petroleum Geologists, 1940; and U. S. Geological Survey Circular 114, *The Water Supply Situation in the United States with Special Reference to Ground Water,* 1951. The author is indebted to Mr. Robert Schneider, U. S. Geological Survey, Minneapolis, Minn., for his criticism of this portion of the paper.

[5] See Geological Survey Circular 114, pp. 102–105.

[6] *Ibid.,* pp. 102–3, 107.

[7] See Stuart L. Schoff, *Salt Water Intrusion in Oklahoma,* U. S. Geological Survey mimeographed report, 1951.

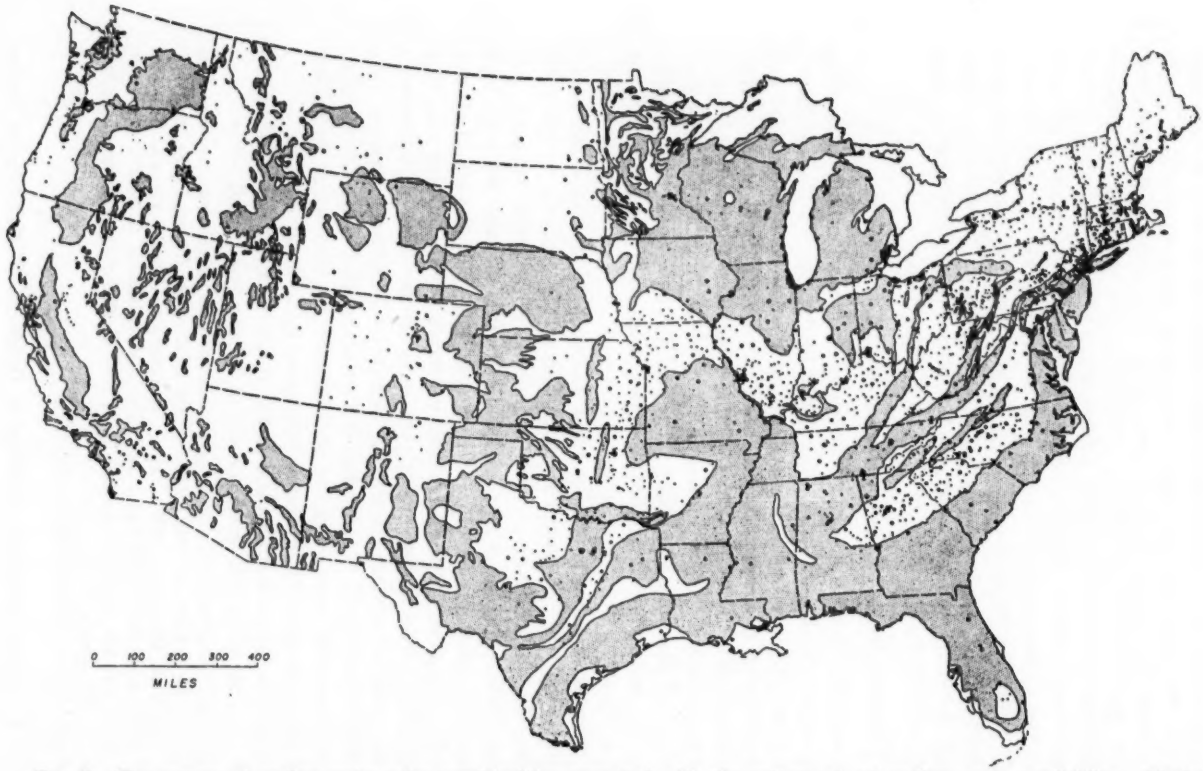

FIG. 2. The pattern of surface-water-using municipalities compared with the pattern of sub-surface water availability. Shaded areas indicate where ground water containing less than 2,000 parts per million of dissolved solids is available at rates exceeding approximately 72,000 gallons per day (i.e., a fresh water supply adequate for a small town of about 1,000 people). Subsurface pattern adapted from map prepared by Dr. Harold E. Thomas, U. S. Geological Survey, for the Conservation Foundation, Fig. 17, U. S. Geological Survey Circular 114, 1951. The same map appears as Figure 8 in *A Water Policy for the American People*, Vol. 1, Report of the President's Water Resources Policy Commission, 1950, and as a plate accompanying H. E. Thomas, *The Conservation of Ground Water*, New York, 1951.

opment in that region. It is related to the relatively low permeability of the Cretaceous and Eocene formations on the plains and the high salinity of the underlying sandstone aquifers.[8] The large number of cities in the mountain west which use surface supplies are in extensive areas of dense, crystalline rocks which are poor aquifers; most of the notable exceptions to these generally poor ground water conditions are in the areas of the porous Columbia lava flows and the major alluvial fans.

There are three other regions in which there is a notable concentration of surface-supplied municipalities notwithstanding generally good ground water conditions. One of these concentrations is in the Puget Sound-Willamette lowland; a second is on the shores of the Great Lakes. In those two areas the surface supply is unusually free of sediment and organic matter and is easier to recover than ground water. A third concentration is in the alluival fan areas of the Los Angeles-San Bernardino plain, where the demand for water far exceeds the available supply from all local subsurface sources.

Three areas of the country have few surface-supplied municipal water systems although they have a relatively high density of towns. Those are the major alluvial plains at the base of the Sierra Nevada and Wasatch Mountains, the areas of eastern Minnesota, Wisconsin, Michigan, northern Indiana and northern Illinois, in which the glacial drift overlies important sandstone aquifers; and South Atlantic Coastal Plain, where thick, loose sands with broad catchment areas in the rainy southeast provide the greatest reservoir of groundwater in the United States.[9]

It is apparent that most of the municipalities that use surface water supplies are located in regions where ground water conditions are poor as a result of high salinity or low permeability of the underlying rock. The striking positive correlation between areas of surface water use and poor ground water conditions is particularly interesting because it was produced mainly by word-of-mouth information and experience passed among individual well-drillers. The two patterns in Figure 2 existed together, after all, many years before any systematic, comprehensive water studies existed. The correlation is a reminder of the vast store of unassembled, unanalyzed data that rests in the records and recollections of "non-professional" technical tradesmen and businessmen in our society.

Where ground water conditions are suitable to meet local demands, surface water is a second choice, usually because of its greater seasonal fluctuation in temperature and hardness together with its comparatively high content of sediment and organic matter.[10] Thus half the population of the United States is served from surface water sources because, in most cases, there is evidently no suitable alternative.

[8] See Geological Survey Circular 114, pp. 108–9.

[9] *Ibid.*, pp. 100–101.

[10] Water temperature Fahrenheit on main streams ranges commonly from the 30's or 40's in mid-winter to the 60's, 70's, or 80's in mid-summer. (See *Quality of Surface Waters in the U.S.*, U. S. Geol. Sur. Water Supply Paper, published annually.) Examination of the *Inventory of Water and Sewage Facilities in the United States* shows generally far more elaborate treatment of the water supplies which are drawn from surface sources.

Location in the Pattern of Surface Water Availability

The average daily runoff map in Figure 3 actually shows the pattern of water yield from the land to surface streams through both direct and indirect runoff.[11] Although the pattern is that of average daily yield, it is identical with the pattern of average annual yield or of total yield during a given period of record. The available yield to streams is a remnant of the precipitation after loss by direct evaporation and "consumptive" use by plants and animals. Consequently regional differences in runoff are much greater than regional differences in precipitation. For example, many areas in the high Sierra Nevada yield 900 to 1000 times as much water per square mile as the nearby Mojave; runoff from southeastern Kansas areas averages 50 to 100 times that from equal areas of southwestern Kansas.

Most of the country has an average daily runoff which is either greater than 250,000 gallons per square mile or less than 20,000 gallons. The Great Plains region is the only wide zone which lies between those two values. On this map (Fig. 3) the areas of over 250,000 gallons runoff are referred to as "high-runoff" regions. The largest number of cities in Figure 3 are within an area of high runoff. A second group includes those cities which are tied to a high-runoff area by a major stream. For example, in the northern Rockies the surface-supplied systems are on the Missouri or its upper tributaries, the Snake or its major upper tributaries, or the main upper tributaries of the Columbia. In the Colorado Rockies and Colorado Piedmont they are on the upper tributaries of the Colorado, Rio Grande, or Platte. A third group of cities is neither within a high-runoff watershed nor naturally tied to one. This group includes cities on the eastern edge of the northern Great Plains, in the James and Red River basins; cities on the southern Great Plains of central Oklahoma and Texas; and cities in southern California. The last comprise the only major cluster of surface-supplied cities in the arid southwest which is not tied by a natural stream to a high-runoff watershed region.

Figure 3 shows that in the high-runoff regions small areas yield a quantity of water sufficient for large cities or large industrial plants. Where the mean daily water yield is 250,000 gallons per square mile, an "average" ten-mile square area (100 square miles) will yield enough water for an average municipality of 125,000 inhabitants in the mountain and Pacific states, and of 250,000 in New England or the southeastern states.[12] Or the same average daily yield of water would cover the average daily demands of—for example—a 30,000 barrel-per-day oil refinery or a thermal-electric station producing 300,000 kwh daily.[13]

Although surface water is used for municipal supplies in 1135 counties, Figure 4 shows that cities in only 15 counties withdraw, on the average, more water than

[11] "Indirect runoff" refers to the water returned from precipitation to streams and lakes and reservoirs via ground water percolation and springs.

[12] Based on per-capita water production data from George J. Schroepfer, et al., "A Statistical Analysis of Waterworks Data for 1945," *Journal of the American Waterworks Association*, XL, No. 10 (October 1948) : 1067–1098, ref. p. 1074.

[13] From data in *Water in Industry*, National Assn. of Manufacturers and Conservation Foundation, 1950.

FIG. 3. The pattern of water runoff in the United States. Numbered isarithms indicate average daily runoff in hundreds of thousands of gallons per square mile. The map is adapted from Walter B. Langbein et al., *Annual Runoff in the United States*, U. S. Geological Survey, Circular 52, 1949. Runoff figures for the original map were computed from stream discharge data and measurements of drainage basin area above each gaging station.

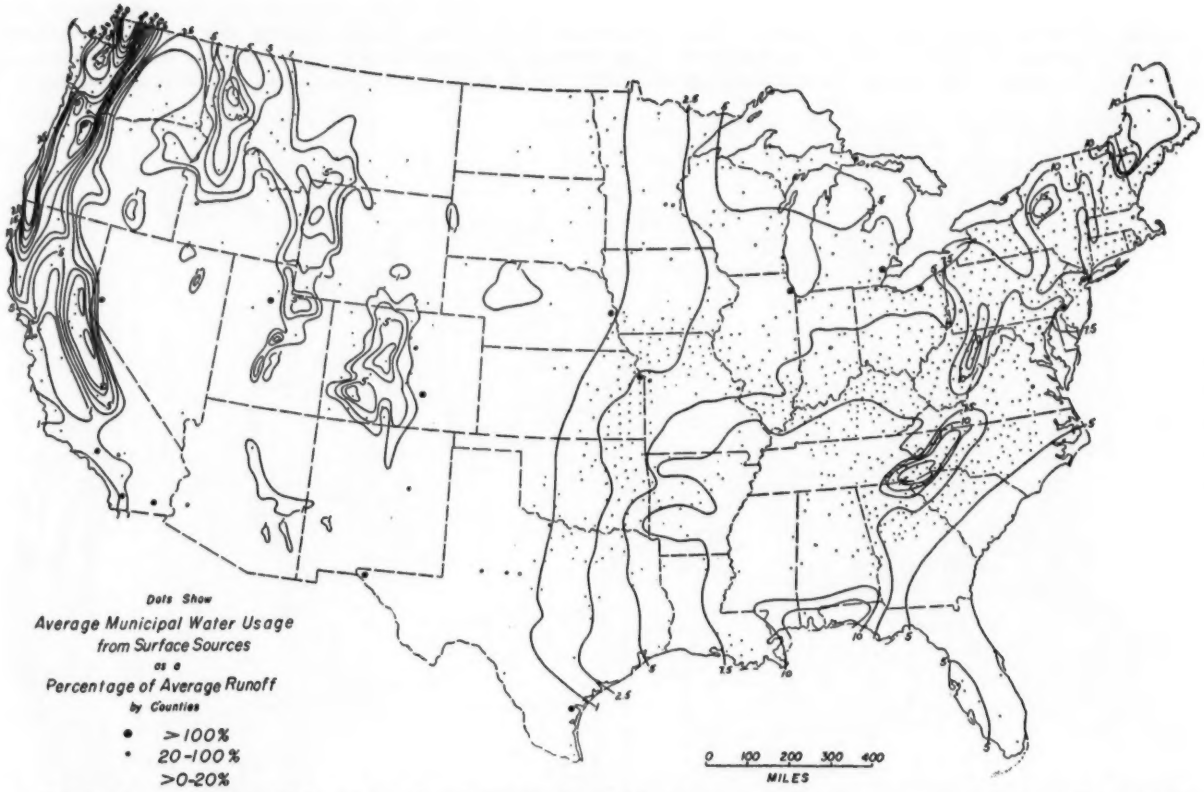

FIG. 4. Average annual withdrawal use of surface water in municipal systems in relation to average annual runoff, by counties. Based on water use data from U. S. Geological Survey map of average annual runoff in the U. S. For cities for which Public Health Service had no data, estimates were made on the basis of census population data and regional per-capita water use figures from George Schroepfer et al., *op cit.*

the land of their county yields. The local "deficit" of water in these counties would be greatly increased if industrial pumpage were added to the municipal use. Figure 4 shows, further, that in 30 more counties municipal systems use annually a quantity of surface water equal to more than 20 per cent of the yield from their respective counties. It may be assumed that most or all of these counties would also be in the "deficit" category if industrial withdrawal uses were added to municipal figures.[14] In the remaining 1,000-odd counties in which surface water is used by municipalities, withdrawal is less than one-fifth the yield of the land. In fact, in 830 counties it is less than 1 per cent of the yield. Thus in most counties in the lowest class group in Figure 4 it is almost certain that total surface water withdrawal for all municipal and industrial purposes is far less than total runoff.

This map does not show where the municipalities in each of the 1135 counties get their water. It does attempt to show the geographic pattern of the relationship between supply and demand within a framework of relatively small areal units. Many communities whose demand could be met from a small drainage basin within the county actually use water from large basins and remote areas. This is especially true in the agricultural mid-West, where a very high proportion of the land is in cultivation, and it is virtually impossible for a municipality to acquire several hundred, or even several score, square miles of land upon which to develop and preserve a forested watershed and small reservoir. Nevertheless, it is obvious from Public Health Service records that most of the municipalities shown in Figure 1 do actually withdraw their water supply from local, small drainage basins.[15] This is indicated by the fact that in the entire country only 86 lakes or main streams are tapped by more than one municipal system. These sources supply about 380 communities. On the other hand, nearly 1,000 systems are supplied by lakes and impounded reservoirs in the upper parts of small basins. These latter systems range in size from the largest to the smallest of those included in this study. Most of the remaining systems use streams discharging from small, local basins. It is also noteworthy that among twenty-six "large rivers" named by the Geological Survey, the main courses of only sixteen are sources of surface water for more than one supply; those streams are pumped by only 185 of the nearly 2,000 surface-water-using municipal systems in the country.[16]

Thus it appears that, with the exception of the major urbanized areas of the

[14] Industrial data parallel to the municipal data used in this study are not available. However, the U. S. Geological Survey estimated the total industrial use of surface water from private sources in 1950 to be 7 to 8 times the total municipal use. (See K. A. MacKichan, *op. cit.*) Analysis of data presented in *Water in Industry* (appendix 13, table 5, p. 32) indicates that in most of the standard metropolitan areas of the country the ratio of industrial to municipal pumpage would be of some similar order.

[15] *Op. cit.*

[16] *Large Rivers of the United States,* U. S. Geological Survey Circular 44, 1949. This brief paper ranks the 26 U. S. rivers with the largest average discharge at their mouths. Those discharges range from 12 billion (Delaware River) to 400 billion (Mississippi River) gallons per day.

northeast and southwest quadrants of the country, the mean annual supply of surface water in local basins exceeds the mean annual local demand for surface water at the present time. There are, however, notable differences in the degree to which this supply must be stored. These differences are related to patterns of stream discharge during times of low water.

Location in the Runoff Pattern of Drought Periods

The map (Fig. 5) attempts to show the pattern of daily average runoff which could be expected during the low-flow months of major drought years. The pattern would occur if there were the "normal" low-month proportion of the annual runoff during a drought comparable to the worst which occurred during the period 1921–1945. Actual daily flow is often lower than that indicated in Figure 5, even in a "normal" year. Comparison of Figure 5 with Figure 2 will identify the major regional differences in dependability of yield from the nation's watersheds during its worst droughts.

Most of the country lies, under these conditions, in an area with an average daily water yield either greater than 100,000 or less than 20,000 gallons per square mile. On this map (Fig. 5) the three major areas with over 100,000 gallons runoff may be referred to as "high-runoff" regions.[17] One high-runoff area is the western high-mountain realm, the crests of the Cascades and northern and Colorado ranges of the Rockies. There meltwater from winter snow is supplemented to a greater extent by summer rains than elsewhere in the western highlands, and glaciated terrain provides many natural reservoirs to stabilize the runoff. The lower runoff of the Sierra Nevada in Figure 5 reflects the greater summer drought in that area. A second large, high-runoff region includes the area of late Wisconsin glaciation in the Great Lakes region as far west as the belt of steep climatic gradients in Minnesota.[18] This is a region in which relatively dependable summer rains and a large spring snow melt are trapped and stored in lakes, ponds, swamps, and extensive areas of coarse sand or gravel terrain. The third large, dependable watershed region is the Appalachian hill country, Piedmont, and southern Alabama-south Georgia-Florida coastal plain. This is a region of high precipitaton amount in all seasons, low variability, and relatively low evaporation. In the northern Appalachians runoff and stream flow are stabilized by glacial landforms assisted in many cases by men's wiers or larger dams. The higher general elevation and associated

[17] J. R. Barnes has noted that a major drought superimposed upon an emergency period when peak industrial production was essential could be distastrous. Viewed against that idea these three watershed regions rank among the country's most basic physical resource concentrations. See "Water for United States Industry," *Report of the President's Materials Policy Commission,* V (1952): 83–98, for Barnes' excellent summary and projection of the over-all U. S. urban and industrial water supply situation.

[18] See maps in C. W. Thornthwaite, "An Approach Toward A Rational Classification of Climate," *Geographical Review* XXXVIII, No. 1 (January, 1948): 55–94; S. D. Flora, *The Climate of Kansas,* Report of the Kansas State Board of Agriculture, June 1948, p. 302, Fig. 2; maps in J. R. Borchert, "Climate of the Central North American Grassland," *Annals of the Association of American Geographers* XL, No. 1 (March 1959): 1–39.

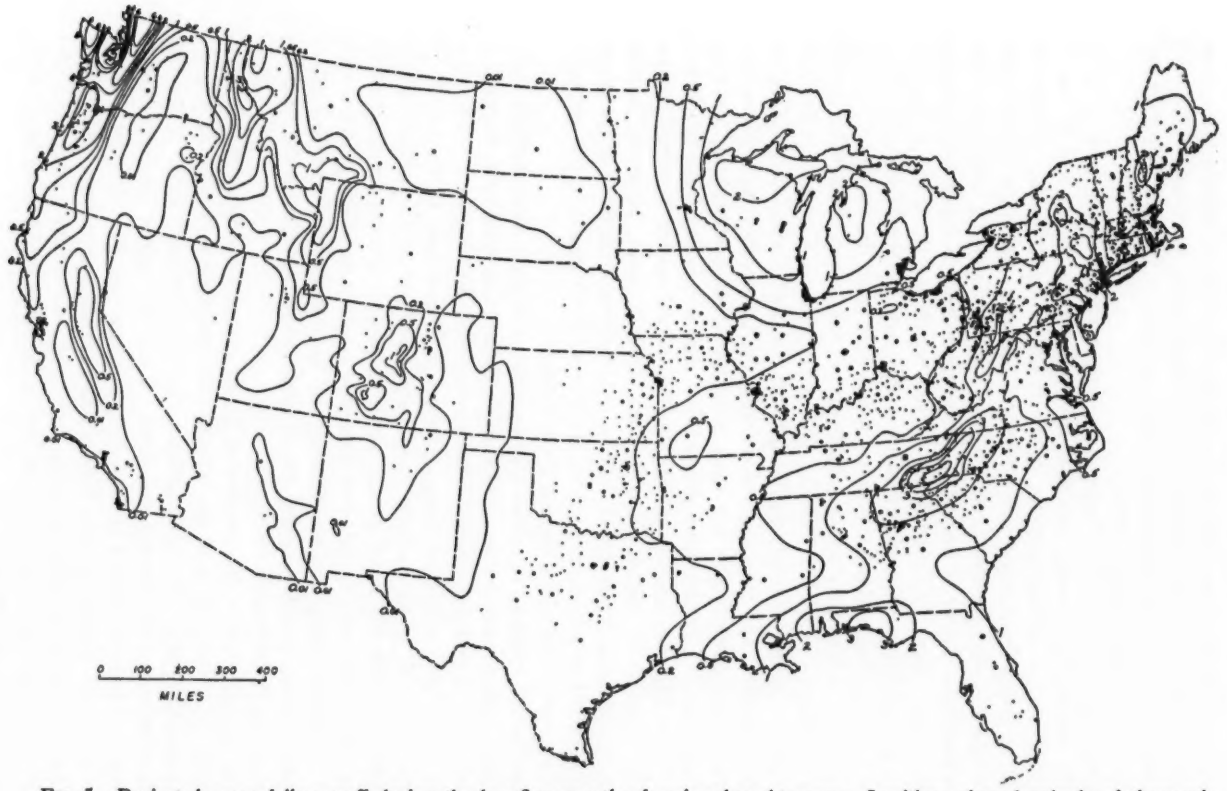

FIG. 5. Projected mean daily runoff during the low-flow month of major drought years. Isarithms show hundreds of thousands of gallons per square mile per day. The map is derived from a combination of data of median runoff during the normal low-water month and the minimum annual runoff over the twenty-five year period, 1921–1945. Data are for 113 "representative gaging stations," from G. E. Harbeck, Jr., and W. B. Langbein, "Normals and Variations in Runoff, 1921–1945," *Water Resources Review,* Supplement No. 2 (Washington, 1949) : 20–25.

very high annual and minimum monthly rainfall in the southern Appalachians more than compensate for the natural storage features found in the northeast. This third main watershed region, in its extent and in the magnitude of both its low-water and total yield, is the greatest in the country.

If Figure 5 be compared with Figure 2, it is apparent that during times of great drought the surface-water-using municipalities of the country are still in one of three kinds of location in relation to the relatively high runoff regions. Within the high runoff areas are those cities in the Pacific Northwest, the upper Great Lakes region, and the Appalachian-Piedmont-Coastal Plain area roughly inside the 100,-000 gallon isarithm. To the second group, these places tied to a high-runoff region by a major stream, must be added those systems which use the south margins of Lakes Erie and Michigan, the middle and lower Missouri, middle Mississippi, Ohio, Cumberland, Tennessee, and other streams which pass from the northern Rockies, glaciated upper Lakes region, or Appalachians into the much droughtier central part of the country. This list includes Cleveland, Toledo, Detroit, Milwaukee, Chicago, and the Calumet district, the Twin Cities, Omaha, Kansas City, St. Louis, Nashville, Charleston, and the principal cities of the Ohio valley, as well as some three dozen smaller places which use Lake Erie, the Ohio, Cumberland, Missouri, and Kanawa rivers.[19] To the third group, those neither within a high-runoff area nor naturally tied to one, must be added in a dry period several hundred systems spread mainly across Kentucky, Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, Oklahoma, Arkansas, and east Texas. These communities draw their water supply from local impounding reservoirs or from streams which originate in this comparatively drought-risky part of the central United States.

The number of counties in which city systems withdraw more surface water than the land yields increases from fifteen under the average conditions depicted in Figure 4 to fifty-one under the drought conditions depicted in Figure 6. The number of counties whose municipal pumpage exceeds 20 per cent of the runoff increases from 30 to 117. There remain, even under these low-flow conditions, nearly 1000 counties in which city water production from surface sources equals less than twenty per cent of the runoff, and more than 700 counties in which it is less than 1 per cent. If private industrial withdrawals and the effect of seasonal fluctuations in public use of water could be added, the number of communities in the first two categories would be increased.

The sharpest increase in the number of deficit counties occurs in that belt extending from the western slope of the Alleghenies across the mid-West to Kansas, thence southward through the mid-continent region to central Texas. Over half the deficit counties in the country are there. Thus the largest concentration of surface-supplied cities in an area of very low minimum runoff in drought years is not in the arid west, but in the mid-Western and mid-continent area. There also is the group of cities whose local drainage basins are most nearly completely under cultivation. Yet, the mid-Western section lies in the heart of the Mississippi basin

[19] U. S. Public Health Service, *op. cit.*

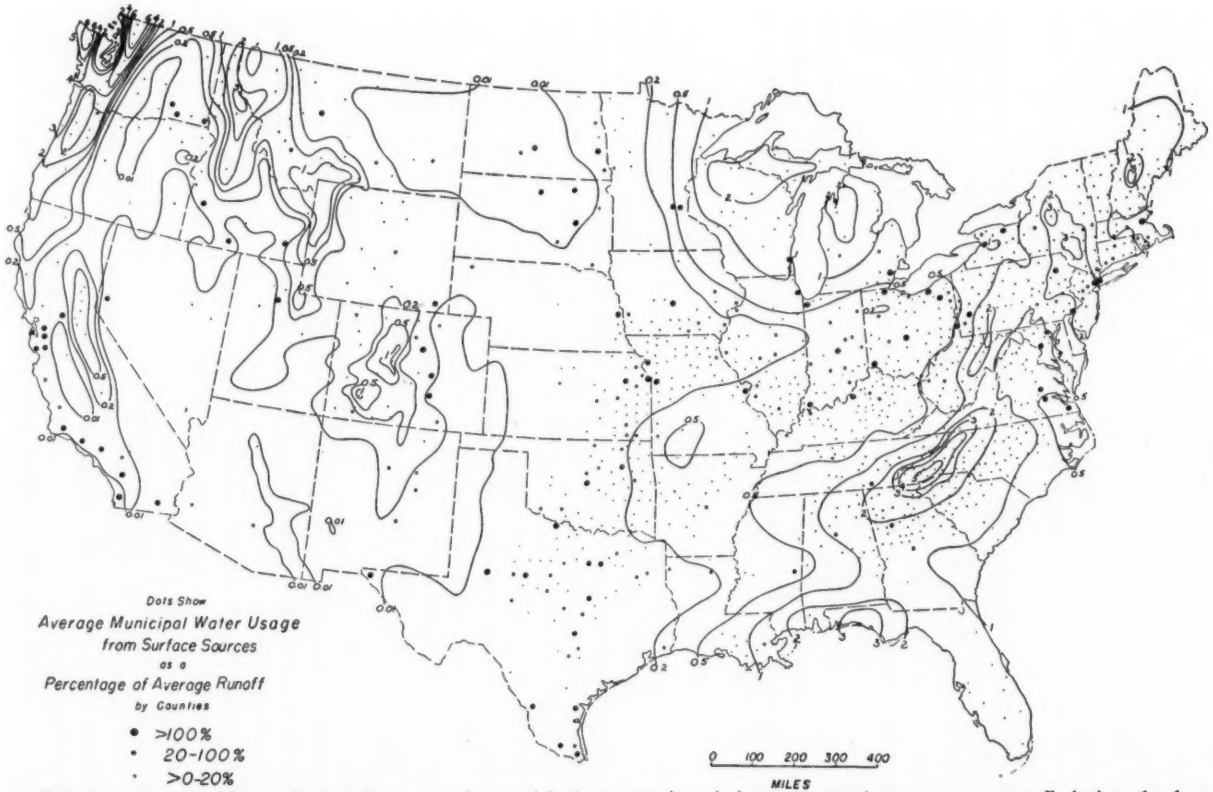

FIG. 6. Average withdrawal of surface water by municipal systems in relation to approximate average runoff during the low-water month of a major drought year. Based on water use data from U. S. Public Health Service, *op. cit.*, and runoff data from U. S. Geological Survey (see explanation of Fig. 5).

and touches the south margin of the Great Lakes. Hence the major storage problems which could otherwise beset the large cities of the area are avoided by using the natural import of large streams. However, a large basin has a greater likelihood of pollution and siltation of its discharge. In the mid-continent area even lower runoff and lack of natural access to any of the country's major watersheds, in contrast with the mid-West, makes large storage reservoirs imperative for cities of all sizes.

The only part of the country's high-runoff areas in which water is required beyond available runoff during a major drought period is the urban-industrial belt between Boston and Washington. There storage and careful management is obviously necessary to utilize the large local-basin supplies. And for the city which turns instead to the use of a master stream the risk of pollution is far greater than that which faces mid-Western cities because of the smaller drainage basins and greater urban and industrial density.[20] This is illustrated by the fact that the entire public water supply of metropolitan New York, if it were drawn from the Mississippi at St. Louis, would use and return less than one per cent of the mean flow of the river at that point.

THE MAJOR CONSUMERS AND THEIR SUPPLIES

The foregoing generalizations have been derived from an analysis of all cities of over 1,000 population which use a surface water supply. Those cities are in 1135 counties and account for practically all of the municipal withdrawal use of surface water in the country. However, about 80 per cent of the total municipal production of surface water is concentrated in the 70 counties were total pumpage averages in excess of 20 million gallons per day. About 75 per cent of the total pumpage is used in 46 counties where consumption averages more than 30 million gallons per day. The 37 counties which use over 40 million gallons per day account for about two-thirds of the national total. Indeed one-fourth of all the municipal supply of surface water in the country is pumped by three systems—New York, Chicago, and Los Angeles.

Figure 7 illustrates the extent of the drainage basins which supply these top water consumers among America's municipal systems. Comparison of Figure 7 with Figures 3 and 5 shows the average annual and average low-month, dry-year runoff in these basins.

It is apparent that the major cities in the high-runoff areas of the Appalachian region and Pacific northwest generally use the impounded water of small local basins in which the city can maintain a high degree of control over land use, cover, and settlement. Intensive, careful development of small basins to supply very large requirements is especially characteristic of the major cities of the middle Atlantic seaboard and northern glaciated Appalachian region. These local basin develop-

[20] *Water Pollution in the United States,* U. S. Public Health Service, 1951, esp. pp. 18–19, 28–33; and Drainage Basin Summery Reports on Water Pollution (15 basin reports covering U. S.), U. S. Public Health Service, 1951.

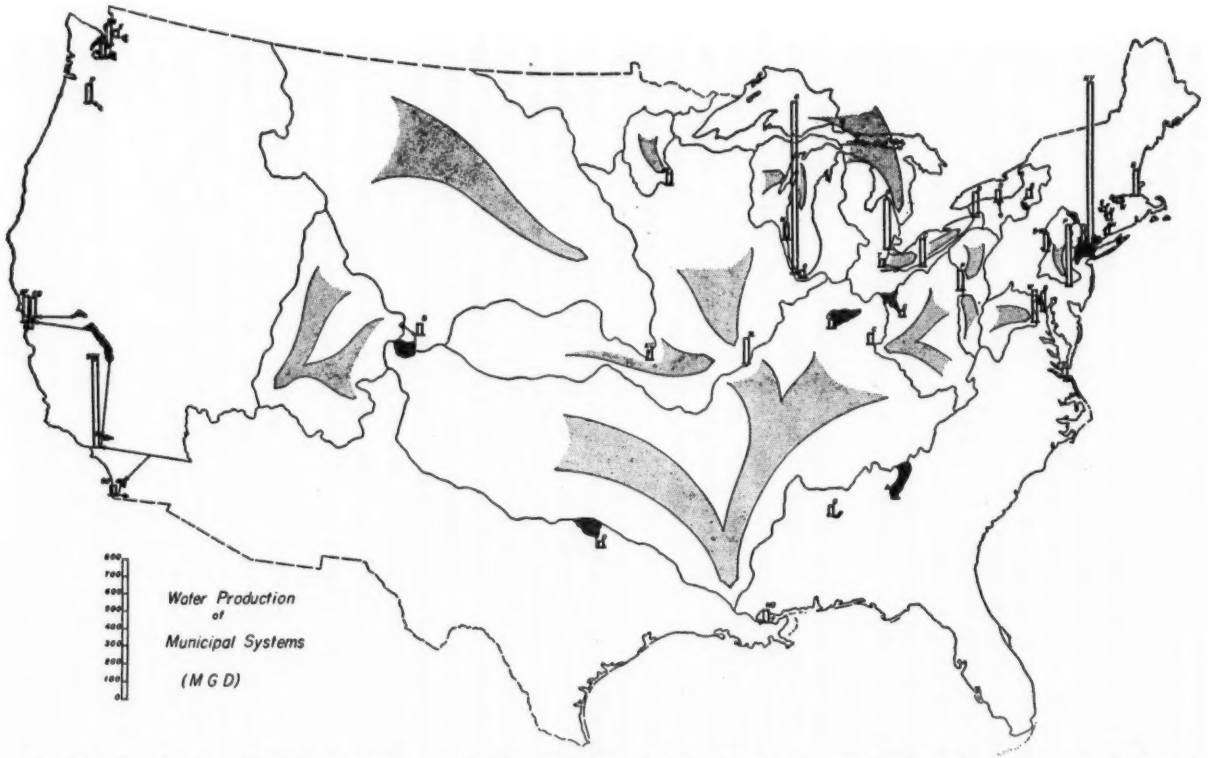

FIG. 7. The location of major metropolitan systems, the extent of their contributive watersheds, and their average daily water withdrawal. Small basins are indicated by pattern showing their area to scale; basins of large rivers are outlined, and arrows within each basin indicate general direction of flow. Withdrawals by systems shown on this map account for about 50% of the total national water consumption by city systems. Map derived from data in U. S. Public Health Service, *op. cit.; River Basin Maps Showing Hydrologic Stations,* Washington, U. S. Weather Bureau, 1949; *13th Annual Rept.* of the Metropolitan Water District of Southern Calif., Los Angeles, 1951; and various topographic maps. Temporary withdrawal from the Hudson River and proposed withdrawal from the upper Delaware River basin for New York City are not shown.

ments are not spectacular, and they have generally been carried out by local governments without federal subsidy. But they develop very large water resources.[21] Somewhat larger watersheds in the Sierra Nevada are tapped by the San Francisco, East Bay, and Los Angeles systems. But these watersheds, too, are on land which is devoted primarily to the production of clean water. Typical treatment of all these supplies involves two to four steps.[22]

Notable exceptions to the general pattern of small reservoirs used for the major eastern systems are the Delaware basin above Philadelphia and the Potomac basin above Washington. The two cities involved, unlike their metropolitan neighbors, have not developed the water resources of small local basins. They use the natural flow of large streams to import water from extensive, populous, busy watersheds. They have, therefore, a more serious pollution problem than do the other large cities of the northeast.

It is also apparent from Figure 7 that metropolitan southern California has a water import problem which is unique in the country.[23] One of the major water sources, the Colorado River, is unique among the rivers which supply the country's metropolitan centers. Because of its physiographic setting the Colorado's waters run almost unused for urban or agricultural purposes to the reservoir above Parker Dam. The water withdrawn from the river at that point is not returned because the using communities are remote from the river and in another drainage basin. The river's climatic setting presents further difficulties. Evaporation and channel loss below Lee's Ferry is equal to almost seven times the total delivery of water to the Southern California Metropolitan Water District. Thus the Colorado, the master stream of the southwest, in addition to being a stream whose average flow is not much greater than that of the Delaware and less than that of Wabash, is a less efficient and more expensive source of water for its municipal users than the other large rivers of the country.[24] Treatment of the Colorado River supply for southern California municipal systems involves from five to thirteen steps, mainly because of the high salt and silt content of the lower river.

In the central United States most large surface-water-using cities pump very

[21] See Edward Higbee, "Three Earths of New England," *Geographical Review,* XLII, No. 3 (July, 1952) : 437.

[22] From data in U. S. Public Health Service, *op. cit.*

[23] Only the upper basin of the Colorado is shown as the contributive watershed for southern California in Figure 7; that section of the basin yields more than 99% of the Colorado River water available for California. The Southern California Metropolitan Water District uses about 2% of the Colorado flow from the upper basin, but other consumptive uses, evaporation, and channel loss take another 79% of the flow. (Metropolitan Water District of Southern California, *op. cit.*, p. 67.)

[24] Estimated average discharge from Lake Mead with present upper-basin depletion is about 19,000 second-feet (Metropolitan Water District of Southern California, *op. cit.*, p. 65); average Wabash River discharge at New Harmony, Indiana, is 27,500 second-feet; Delaware River discharge at Trenton, N. J., averages 14,900 second-feet (U. S. Geological Survey Circular 44, p. 2).

small fractions of the major streams or Great Lakes upon which they are situated.[25] For example, the municipal systems at St. Louis, Kansas City, and Cincinnati withdraw less than 0.1 per cent of the river flow at those places. The others impound the upper-basin discharge of tributary streams, such as the Scioto or White (Indiana), in areas which are rather heavily populated and generally cultivated. Those upper basins are in areas of persistently low runoff in the mid-continent setting exemplified by Dallas. Compare, for example, the areas of the contributive drainage basins for Dallas and Syracuse, N. Y. (Fig. 7). Municipal water production is about the same at both cities; runoff per square mile in the small basins above Syracuse averages about six times that above Dallas (see Fig. 3). Treatment of these supplies in the central United States involves typically from eight to thirteen steps because of the high sediment and organic content and, often, high acidity from industrial waste. Treatment is generally less for cities along the Great Lakes.

On the Gulf Coastal Plain wells supply cities which use as much water as many of the municipalities shown in Figure 7. Those places include San Antonio, Houston, Memphis, and Miami. The latter three cities do not use the relatively abundant surface water supply of the humid southeast because of the large, available sub-surface supply of the coastal plain aquifers. San Antonio is able to avoid the surface water storage problems of Dallas and other cities of the mid-continent low-runoff region by its use of the coastal plain ground water reservoir.[26]

Thus analysis of Figure 7 illustrates with specific major cities the regional characteristics of surface water supply of American municipalities which have been drawn from Figures 3–6.

SUMMARY AND CONCLUSION

Analysis of the location of American surface-water-using municipalities within the geographic patterns of surface water supply shows that the average yield of water from the land in relation to existing municipal demand is abundant in all parts of the country except southern California. The use of these local supplies involves the greatest storage problems in 1) the semi-arid and arid regions of the country because of low runoff, and 2) the agricultural mid-West because of large year-to-year variability of runoff coupled with a high proportion of open-tilled crop land in the drainage basins. Greatest development of small basins to meet major municipal demands is in the northeastern states, with the notable exceptions of Washington and Philadelphia, and few much smaller cities. The greatest use of surface water in areas of low runoff—and potentially most serious actual supply

[25] (From data in U. S. Public Health Service *op. cit.* and U. S. Geological Survey, *Surface Water Supply of the U. S.* published annually). If all other demands were added to the municipal requirements these cities would still use a small fraction of their available supply of river water.

[26] For an excellent bibliography on these areas, see H. E. Thomas, *The Conservation of Ground Water*, N. Y., 1951, pp. 307, 309, 311, and 317; see also W. H. Goines, et al., *Water Supply of the Houston Gulf Coast Region*, Texas Board of Water Engineers Bulletin 5101, 1951.

problems if present trends were to continue—are in southern California and the belt from east-central Kansas to south Texas. The municipalities which utilize available supplies to the smallest degree, have the greatest leeway for increased water use, and have accesss to the largest flow in drought periods are in the southeastern states, especially the southern Appalachians, in the Pacific Northwest, along the Great Lakes, and along the large rivers of the agricultural mid-West.

Perhaps because in most parts of the country the supply is abundant in relation to past and existing municipal demands, no other physical resource has been developed with so little regard for regional differences in its concentration as water for our urban areas. Yet the pattern of these differences is of major importance. This limited study points to a number of major regional and national water supply and utilization characteristics which require further geographical analysis. The words of H. E. Thomas—". . . the exhaustive analysis and scientific interpretation lag far behind the collection of the basic data for all phases of the hydrologic cycle . . ."[27]—apply no less to geographical than to other methods of analysis.

[27] *Op. cit.*, p. 233.

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SMALL–SCALE CONTINENTAL LANDFORM MAPS

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A PROPOSAL to portray the surface features of the continents on a new basis at this late date must be deemed presumptuous unless it may reasonably be contended that existing maps are inadequate, at least for some purposes, and that certain advantages may be gained by the specific new approach.

The maps of configuration which have been drawn in the past have employed a variety of techniques and have achieved a wide range of effects. If we evaluate them primarily in terms of their adequacy for use in the classroom or in small atlas or textbook plates, we must conclude that in varying degrees they have fallen short of the mark. For some the chief deficiency is lack of simplicity or clarity; for others it is misleading representation of the terrain.

Much of the problem of adequacy resolves about matters of scale. In the contour map and the relief model we have techniques for representing clearly, accurately, and in detail the surface form of a limited area. As the scale of the representation is increased the completeness of detail may be increased. Carefully drawn contour maps or models constructed at scales no smaller than one inch to a mile are satisfactory representations for the vast majority of purposes. However, if large areas are being studied, the size of map, or alternatively the number of small maps which the use of such large scales necessitates, becomes a serious and often vitiating obstacle. Furthermore, the use of large scale maps for showing very large areas compounds such a staggering total of individual features that the eye and the mind become lost in the welter of detail and one begins to grope for some means of simplification and generalization.

One obvious measure for meeting these difficulties is reduction of the scale of representation, but this in turn raises additional problems of its own. No longer is it possible to show all significant features. The sacrifice of detail at scales below 1:500,000 or 1:1,000,000 becomes tremendous, and contour maps or models on such scales are no longer faithful reproductions of the actual terrain. Individual ravines, ridges, and benches must be omitted, and the distinctive texture of the topography is thereby lost. A mountain range is no longer a picturesque or forbidding maze of spurs, gullies and jagged crests, but simply a featureless protruding rib, its character generalized out of existence. On maps of entire continents, drawn on scales of 1:5,000,000 or less, even individual ranges or major valleys on plains may be lost, only broad mountain systems and extensive plains being distinguishable. This loss of detail with decreasing scale of mapping is in large measure inevitable, but the relative value of different small-scale representations depends upon the degree to which they retain the distinctive character of the terrain without undue sacrifice of simplicity. The generalization made to accompany reduction of scale of any map must be planned at least partly in terms of visual clarity. It may be achieved principally through reduction in the number of separate features or areas distin-

guished and through simplification of outlines or boundaries. But those distinguishing characteristics of each area which are most significant for the purpose in hand must still be clearly shown.

It has been suggested that maps thus far employed for small-scale representation of continental areas either misrepresent the nature of the terrain or are too complex to be read swiftly or at a distance. Most are of the familiar altitude-tint variety; in effect, highly generalized contour maps. It is true that contour maps, if drawn on a large scale, actually show much more than mere elevations. From the pattern of the contours may be read most of the complex characteristics of the surface which one wishes to know. But as soon as a contour map is strongly generalized, it loses most of its value. The hypsometric-tint maps of the continents show only the element of elevation, in arbitrarily delimited and often meaningless classes, together with some idea of local relief, provided that the local relief is very large. Almost no no idea is conveyed of the roughness of the land, possibly the most important element of all. Thus on such maps of the United States the Ozarks will often appear the same as northern Wisconsin. The western Great Plains appear higher, and hence, it is likely to be inferred, rougher, than the Appalachians, and along a highly indefinite western edge these same Great Plains give way gradually to a vast and amorphous highland, the various parts of which are distinguished as "Colorado Plateau" or "Rocky Mountains" by names printed on the map. The system is somewhat more effective for maps of Europe, but only because of a peculiarly felicitous correlation between elevation and roughness in that continent.

Some considerable advantage is gained by the addition of hachuring or plastic shading to an altitude-tint map. This system is used in several of the fine wall map sets, such as those of Haack and Wenschow, which are familiar to most geographers. However, while this shading helps to separate the roughest lands from the rest, it tends to reduce complex mountain systems to single ridges, to make canyons out of shallow valleys of major streams, and to leave all areas which are not strongly mountainous looking monotonously flat. On large-scale maps, however, such as the famous Kümmerly and Frey *Switzerland,* this combination of hachuring and color may give excellent results.

Much the same is true of the "physiographic diagrams" or "landform maps" of the type made familiar by Lobeck, Raisz, and others. These maps are effective for large-scale representation or even for small-scale maps provided they may be closely scanned, but they cannot be used successfully as wall maps. Even as desk maps they offer certain minor difficulties to interpretation, largely because of the tendency to exaggerate the irregularities of plains and thus to decrease regional contrasts.

Particularly in European sources one encounters "tectonic-morphologic" maps, some of which are simply maps of geologic structure, while others attempt to indicate something of surface form as well. However, though the maps may be valuable adjuncts to the teaching of regional geomorphology, they usually give short shrift to the present terrain.

Finally, there have been several attempts to map continental landforms on a "landform type" basis, that is, by recognizing a few distinctive classes of terrain and mapping the occurrence of those classes. These methods will be discussed at greater length below.

For most geographical purposes, landform maps should show actual characteristics of the existing surface rather than genetic interpretations. Those who are concerned with the relationships of the landform pattern to other patterns, physical or cultural, are more often concerned with the present form of the surface than with the origins of that form. Furthermore genetic characterizations suffer from being essentially theoretical, often grossly inaccurate, especially in the less-well-known areas of the earth, and sometimes very misleading. The ambiguity of such terms as "drift plains," "dissected plateau," "karst," or "fold mountains" as characterizations of surface configuration is obvious. Nor does careful reflection bear out the contention that genetic characterization simplifies or systematizes the description of landforms. One need only examine some of the attempts to classify landforms genetically to perceive that the genetic approach is no guarantee of either system or simplicity.

Small-scale representation requires that the terrain characteristics upon which the map is to be based be those of *areas,* not simply of individual features. The question of which of the many attributes of the configuration are to be shown is highly complex, and the selection differs depending upon the purpose at hand. Generally speaking, the principal characteristics of the surface may be grouped under the headings of relief, slope, pattern, and material. Following considerable experimentation, the following elements have been selected from within those general headings as proving especially valuable in terrain characterization: local relief, "flatness" of the land, characteristic profile, characteristic pattern of ridge lines or valley floors, and physical character of surface material (as water, bare bedrock, sand, soil, etc.). The first three named are believed to be the most diagnostic in the greatest number of cases.

Local relief may be figured in various ways, the least subjective being the familiar method of ascertaining the maximum difference in elevation within a given small area. "Flatness" of the land is expressed in a surprisingly useful manner by the fraction of the given area which has an inclination less than some chosen boundary values. The characteristic profile from drainage axis to divide is an inherently complex element, but a first approximation to it may be made by indicating where in the profile the "flat" land lies. The question of pattern is similarly complex, particularly if one considers not only the arrangement itself, but also the scale of features. However, patterns, like profiles, can be grouped into a few generalized classes, and various indices can be devised to indicate the average spacing of drainage lines or otherwise to express the "texture" of the terrain. Surface materials may be expressed in terms of an index showing the degree of prevalence of one or more of the distinctive types of material. Especially valuable is an index giving the percentage of the area which is occupied by lake or swamp.

Based upon these elements there might be set up a wholly systematic natural classification having five or more levels or categories, each category being subdivided into a number of classes according to the variation of the particular element. However, such a classification, though rather nicely discriminating, would be far too complex to serve directly as the basis for small-scale landform maps. If no more than five subdivisions were made in each category, the total number of combinations possible in the five category system would exceed three thousand. Even if only the top three categories were used, the possible combinations would total one hundred twenty-five. Since not more than ten or twelve classes can be shown on a small-scale map because of the difficulty of distinguishing between symbols or colors, it is clear that the number of terrain types would have to be drastically reduced by means of grouping.

The maps which accompany this paper (Figs. 1 and 2) employ one such grouping, based upon a systematic three-category classification in which the differentiating characteristics are local relief, flatness, and profile.[1] A few selected classes from the category of physical character of surface material have also been added. It is not desired that the exact quantitative values of the class and group boundaries be overemphasized. Their purpose is to promote objectivity in classifying a given piece of terrain, to make possible the comparison of different regions, and to insure comparability of results obtained by different people. A quantitative classification is a tool, and not an end in itself. No attempt has been made, as yet, to employ statistical analysis as an aid in choosing the most valuable boundary values. They could reasonably vary, depending upon the region and the purpose for which the classification is made. For the present paper, the attempt was made to choose values which would separate distinctive kinds of terrain found in North America. The

[1] The systematic classification on which the grouping used on the maps is given below. The individual in the classification is a 7½ minute rectangle. (In high latitudes the east-west dimension should be increased and in low latitudes it should be decreased in order to maintain a reasonably constant size in spite of poleward convergence of the meridians.)

Category 1, local relief (maximum difference in elevation)

Class A—0 to 100 feet
B—100 to 300
C—300 to 1000
D—1000 to 3000
E—3000 and above

Category 2, per cent of near-level land (slope of less than 8 per cent)

Class 0— 0–10 per cent
1—10–20
2—20–30
3—30–40
4—40–50
5—50–60 per cent
6—60–70
7—70–80
8—80–90
9—90–100

Category 3, profile expressed in terms of distribution of the near-level land.

Class a—Nearly all is near-level land (less than 8 per cent slope).
b—Near-level land divided between upper and lower halves of the elevation range.
c—More than two-thirds of the near-level land is in lower half of the elevation range.
d—More than two-thirds of the near-level land is in upper half of the elevation range.

entire problem of rational selection of class limits is one deserving of much further attention.

Approximate definitions of the groupings or terrain types shown on the maps are as follows:

I. *Nearly flat plains.* Lands of low relief and a very high percentage of near-level land. Profile not critical.

II. *Rolling and irregular plains.* Lands of rather low relief and a high percentage of near-level land. No high steep slopes. Profile otherwise not critical.

III. *Plains with widely-spaced hills or mountains.* Lands of moderate to high relief, but with a high percentage of near-level land. Much of the level land is relatively low-lying.

IV. *Partially dissected tablelands.* Lands of moderate to high relief, but with a high percentage of near-level land. Much of the level land is relatively high-lying.

V. *Hills.* Lands of moderate relief, but with a low percentage of near-level land. Profile not critical.

VI. *Low mountains.* Lands of high relief, with a low percentage of near-level land. Profile not critical.

VII. *High mountains.* Lands of very high relief, with a low percentage of near-level land. Profile not critical.

In addition to these seven classes based upon relief, flatness and profile, an eighth class is recognized, based upon the distinctive character of the surface material:

VIII. *Ice caps.* Extensive fields of permanent ice.

This type of terrain is fairly extensive in occurrence and clearly does not fit adequately into the other classes.

The attempt has also been made to anticipate certain objections by distinguishing in addition to the eight major classes, the poorly-drained phases of the plains, tablelands, and plains with widely-spaced mountains classes. This permits the setting apart of such distinctive regions as the Canadian Shield and adjacent morainic plains, the outer Coastal Plain, and the Upper Paraguay swamps, which otherwise would not be distinguished from other plains. It is not felt necessary to carry this distinction over into the hill and mountain classes where there is little flat land.[2]

In Africa and Asia, it might be found desirable also to indicate a sandy phase of plains and hills in order to distinguish the vast sand-dune areas of the desert re-

[2] On the basis of the systematic classification offered above, the seven major terrain classes represent groupings made as follows:
Nearly flat plains: A8, A9; any profile.
Rolling and irregular plains: A2 to A7, B5 to B9; any profile. C5a to C9a.
Plains with widely-spaced hills or mountains: C5c to C9c; D5c to D9c, E5c to E9c.
Partially dissected tablelands: C5b or d to C9b or d, D5b or d to D9b or d, E5b or d to E9b or d.
Hills: A0 and A1, B0 to B4, C0 to C4. Any profile.
Low mountains: D0 to D4. Any profile.
High mountains: E0 to E4. Any profile.
The two added classes are:
Ice-caps: More than 50 per cent of the area is covered by permanent ice.
Poorly drained lands: More than 10 per cent of the area is covered by lake or swamp.

gions. In the Americas, sand-dunes are so restricted in occurrence that it has not been deemed necessary to include such a designation on the accompanying maps.

The property of elevation, which is in effect an aspect of location rather than configuration, has not been included in the classification. However, since two-dimensional cartography does not distinguish vertical positions, it has seemed advisable to distinguish by symbol the extreme high-altitude phases of plains and tablelands, so that the distinctive position of such plains as the Bolivian Altiplano may be appreciated.

Mapping these various types on a strictly quantitative basis would require quantitative information which is not available for large sections of the world. It would also require a tremendous amount of time. However a reasonable approximation may be made on the basis of such data as may be quite readily assembled. It is believed that the majority of the world's terrain regions will fall fairly clearly into one or another of the eight types, and that careful perusal of available information would permit the drawing of generally accurate terrain-type maps of the sort proposed for all of the continents. The possession of additional quantitative data would probably permit no more than the refinement of detail; it would hardly change the major lineaments of the pattern.

The maps accompanying this paper were compiled largely from the most readily available map sets, principally samplings from the U.S.G.S. topographic series, the Millionth Map of Hispanic America, the 1:1,000,000 Aeronautical Charts, and the landform maps of Alaska, Canada, and the United States by Erwin Raisz. Careful quantitative determination was made for a considerable number of sample topographic quadrangles from various sections of the United States. Reliability of the maps is greatest in the eastern and far western United States, and probably lowest in the Canadian Shield and interior South American areas. The large contour intervals of the Millionth Map and the Aeronautical Charts do not permit adequate separation of the various low and moderate relief categories.

Study of these new maps rather naturally yields few surprises. Indeed it is the purpose of the maps to bring out patterns which should already be reasonably familiar to those who have had geographical training. However it is felt that a number of ideas are presented more clearly or in a different manner than on previous small-scale maps.

One of the most useful innovations appears to be the introduction of the "plains with widely-spaced mountains" category, which turns out to be very extensive in occurrence, and which almost certainly characterizes southwestern North America more meaningfully than does the designation "plateau," which has often been employed (Fig. 1). Preliminary consideration of the rest of the world indicates that this class of terrain is one of the most extensive of all, particularly in southern Eurasia and parts of Africa.

Hill-lands in Eastern North America stand out clearly in some areas where they are often slighted, notably in the Ozark-Highland Rim area, central Texas, and northern and eastern Canada. Quite possibly there should be a broader extension

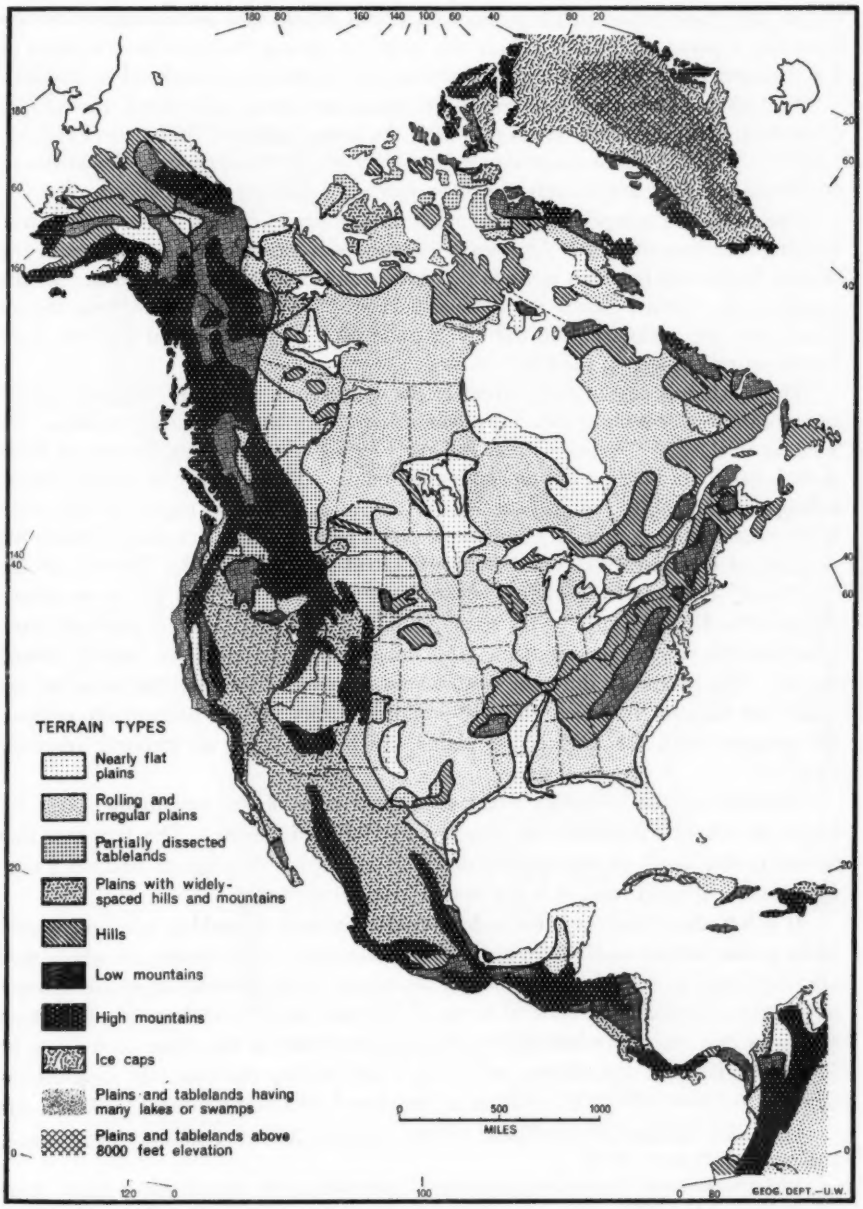

TERRAIN TYPES
Nearly flat plains
Rolling and irregular plains
Partially dissected tablelands
Plains with widely-spaced hills and mountains
Hills
Low mountains
High mountains
Ice caps
Plains and tablelands having many lakes or swamps
Plains and tablelands above 8000 feet elevation
0 500 1000
MILES
GEOG. DEPT.—U.W.

FIG. 1.

of the hill classification in the eastern Canadian Shield and in the interior of the Brazilian Upland (Fig. 2). These are however among the least-known areas of the Western Hemisphere, and their characterization must be considered provisional.

"Tablelands," with their restricted definition, are quite widespread, though not coincident with all of the areas to which the term "plateau" has generally been applied. It would not be surprising if, in such poorly-known areas as interior Brazil and Patagonia, they are actually much less extensive than the maps indicate (Fig. 2).

The mountain categories appear much as one would expect. The gaps in the western cordillera of North America are quite apparent, as are the openings in the central Andes and the high spots in the eastern uplands of both continents. In the southwestern United States the extensive rugged mountains of the Prescott-Salt River area are set apart from the much smoother Colorado Plateau and the more widely-spaced ranges of the Great Basin.

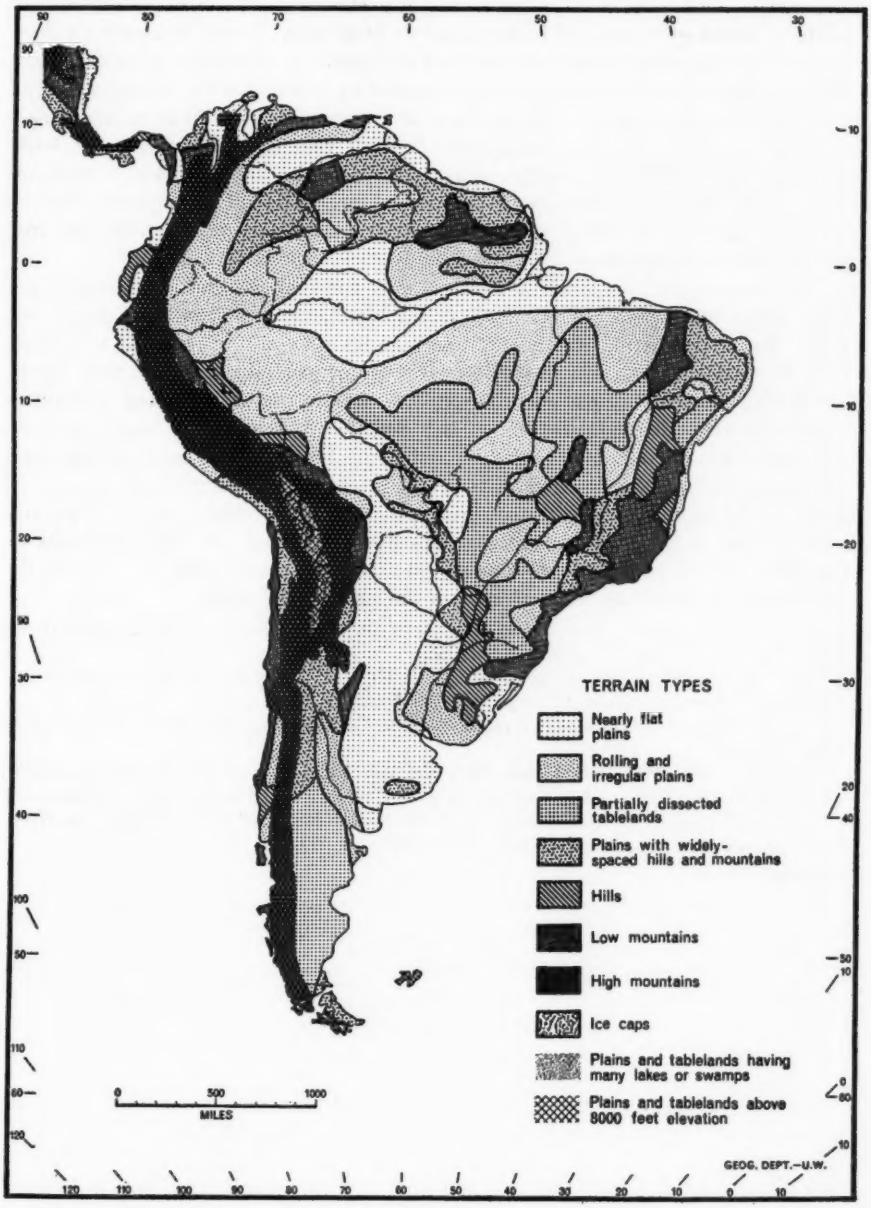
The distinguishing of the extremely flat lands from the more irregular plains appears to be worthwhile, especially where they occur at elevations well above sea level, as in the Lake Agassiz Plain and the Llano Estacado. The flatness of these areas is often not brought out on continental maps. The accuracy of the flat plains-rolling plains boundary in interior South America is, of course, highly questionable. Rather interesting are the large extent of plains terrain in the Brazilian Upland, the removal of the deeply dissected northern Great Plains from the "plains" to the "tableland" class, and the virtual separation of the central from the southeastern plains of the United States by the strip of hill lands. A separation of glaciated from non-glaciated country is not made, and indeed on a configuration map it should not be. The genuinely different lake-swamp sections of the glaciated area are set apart, but the rest, in which glacially-produced forms are not particularly evident, the grouped with the unglaciated plains which they often so strongly resemble (Fig. 1).

Another familiar boundary which does not appear on the new maps is that between the Great Plains and the Osage and Old Drift plains. The fact that that boundary has never proved readily definable or defensible suggests that on a configurational basis, at least, it is not one of prime importance.

It is felt, then, that these maps do indeed contribute something new and worthwhile to the field of small-scale terrain representation. The system on which they are based may be considered as roughly analogous to the familiar objective systems of climatic classifications such as those of Köppen and Thornthwaite. It follows somewhat the recommendations for objective presentation that have been made by Passarge,[3] Kesseli[4] and others and extends and refines the four-fold subdivisions (plains, plateaus, hill-lands, mountains) employed with some success by Finch and

[3] Siegfried Passarge, *Beschreibende Landschaftskunde* 2nd ed. Hamburg: Friederichsen, DeGruyter, 1929 pp. 4, 10–55.

[4] John E. Kesseli, "Geomorphic Landscapes," *Yearbook of the Association of Pacific Coast Geographers,* XII (1950) : 3–10.


TERRAIN TYPES
Nearly flat plains
Rolling and irregular plains
Partially dissected tablelands
Plains with widely-spaced hills and mountains
Hills
Low mountains
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Plains and tablelands having many lakes or swamps
Plains and tablelands above 8000 feet elevation
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MILES
GEOG. DEPT.—U.W.

FIG. 2.

Trewartha,[5] and by Kendall, Glendinning and MacFadden.[6] It is perhaps closest to the morphological maps of Linton,[7] and de Martonne,[8] though it avoids the remnants of genetic classification still retained by them. It represents a logical extension to large regions of the principles suggested by Linton for the distinguishing of small geomorphic regions.[9] In the form of a systematic classification based upon the five or more categories mentioned above, it can be employed for the fairly detailed representation of smaller areas, perhaps of the dimensions of a medium-sized state. For quite detailed studies, however, it should be supplemented by contour maps and by verbal description which would convey more fully the true flavor and the subtleties of the landscape.

In summary, the maps show clearly the continental patterns, are simpler and more legible at a distance than the physiographic diagram or "landform" maps, and define the nature of the terrain more accurately, especially in areas of low relief, than do small-scale maps of the hypsometric tint or generalized shaded relief types. As in all small-scale maps, much is left out, notably the arrangement of features within the areas distinguished, but it is hoped that in general the most diagnostic and distinctive characteristics have been shown. Since the different terrain types are capable of quantitative definition, rough inter-regional comparison is possible. Further, the representation is based on a system which permits any desired amount of expansion of detail as the scale of mapping is increased. Finally, the maps do not attempt to indicate the probable origin of the terrain features but present the configuration empirically as an element of the natural landscape.

[5] V. C. Finch and G. T. Trewartha, *Elements of Geography.* 3rd ed.; New York: McGraw-Hill, 1949. pp. 257, 344, 355, 370, and Plate V.

[6] H. M. Kendall, R. M. Glendinning, and C. H. MacFadden, *Introduction to Geography.* New York: Harcourt, Brace, 1951. pp. 182–186, Plate IV.

[7] J. Bartholomew, *The Advanced Atlas of Modern Geography.* New York: McGraw-Hill, 1950. Plate 32.

[8] Emmanuel de Martonne, *France Physique,* Vol. VI, part 1, of *Geographie Universelle,* ed. P. Vidal de la Blache and L. Gallois. 15 vols.; Paris: Armand Colin, 1947. facing p. 280.

[9] David Linton, "The Delimitation of Morphological Regions," *London Essays in Geography.* Cambridge: Harvard University Press, 1951. pp. 199–218.

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UPSTREAM STORAGE PROBLEMS IN COLUMBIA RIVER POWER DEVELOPMENT

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IN spite of the enormous hydropower potential of the Columbia River, reasonably full utilization requires extensive upstream storage. Storage is necessary to regulate the great fluctuations in stream flow, which have ranged from a minimum of 36,000 c.f.s. (1937) to a maximum of 1,240,000 c.f.s. (1894).[1] Provision for storage, however, poses a baffling problem, contrary to the general notion that reservoir sites are readily available in the mountainous West. Although the engineering and economic factors are favorable at a number of potential sites, political, aesthetic, resource, and, above all, regional conflicts have brought action on the storage phase of Columbia River power development to a halt. If the necessary storage can be obtained, the Northwest can meet its enormous electrical energy requirements from its hydropower resources.

COLUMBIA BASIN POWER PLAN

The storage system under consideration is limited to the large reservoirs needed to provide major regulation of the Columbia River. The Columbia power system was planned as an extension of the existing federal system to meet a load estimated for the foreseeable future at 10,000,000 kilowatts.[2] The plan called for an aggregate of 20,000,000 acre-feet of upstream storage capacity, to be obtained in six reservoirs (Fig. 1):

Project	Active Storage (acre-feet)
Grand Coulee	5,120,000
Hungry Horse	2,980,000
Albeni Falls	1,140,000
Glacier View	3,160,000
Libby	4,250,000
Hells Canyon	3,880,000
Total	20,530,000

The reservoirs were selected after examination of many sites, and careful balancing of engineering and economic factors and damages to local communities and resources. Taken as a group, these reservoirs would approximately triple the prime power[3]

[1] U. S. Army, Corps of Engineers, *308 Report on Columbia River and Tributaries (1948)*, Appendix L, Plate 11. Much of the information in this paper has been drawn from the *308 Report*.

[2] *308 Report*, p. III–15. See also Appendix N (Bonneville Power Administration) for power market studies and estimates.

[3] Prime power is defined as the hydroelectric power available on a continuous basis under the most adverse hydrologic conditions contemplated. It is the "ready kilowatt."

capability of the planned system by supplementing the low natural flows during the eight-month storage drawdown period September to April inclusive (Fig. 2).

Present Development

Accomplishment to date in providing the recommended storage capacity has been disappointing to all Pacific Northwest power interests. Only two upstream storage projects have been constructed during the post-war period, while four downstream run-of-river plants have been placed under construction. The latter plants have no storage, depending entirely on the upstream reservoirs for river regulation. Construction has been started on The Dalles Project; the other three are nearing

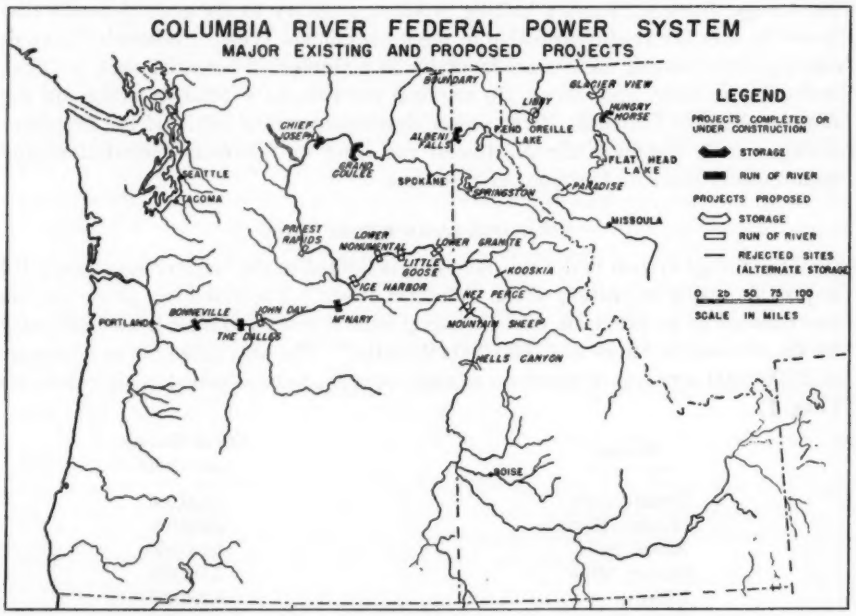

FIG. 1.

completion. Bonneville Dam, the lowest of the run-of-river projects, was completed before World War II. Six other downstream projects are recommended for early construction, two on the Columbia and four on the lower Snake. These would likewise depend on the upstream storage reservoirs for regulation. The provision of upstream storage, thus, is lagging behind the provision of downstream generating capacity. Financial justification of the downstream plants is lessened in the absence of adequate upstream storage.

The effects of inadequate storage are serious in a period of water shortage, like that which occurred in the unusually dry autumn of 1952. Hydrogeneration in the Pacific Northwest on November 1 was only 2,300,000 kilowatts, less than half of

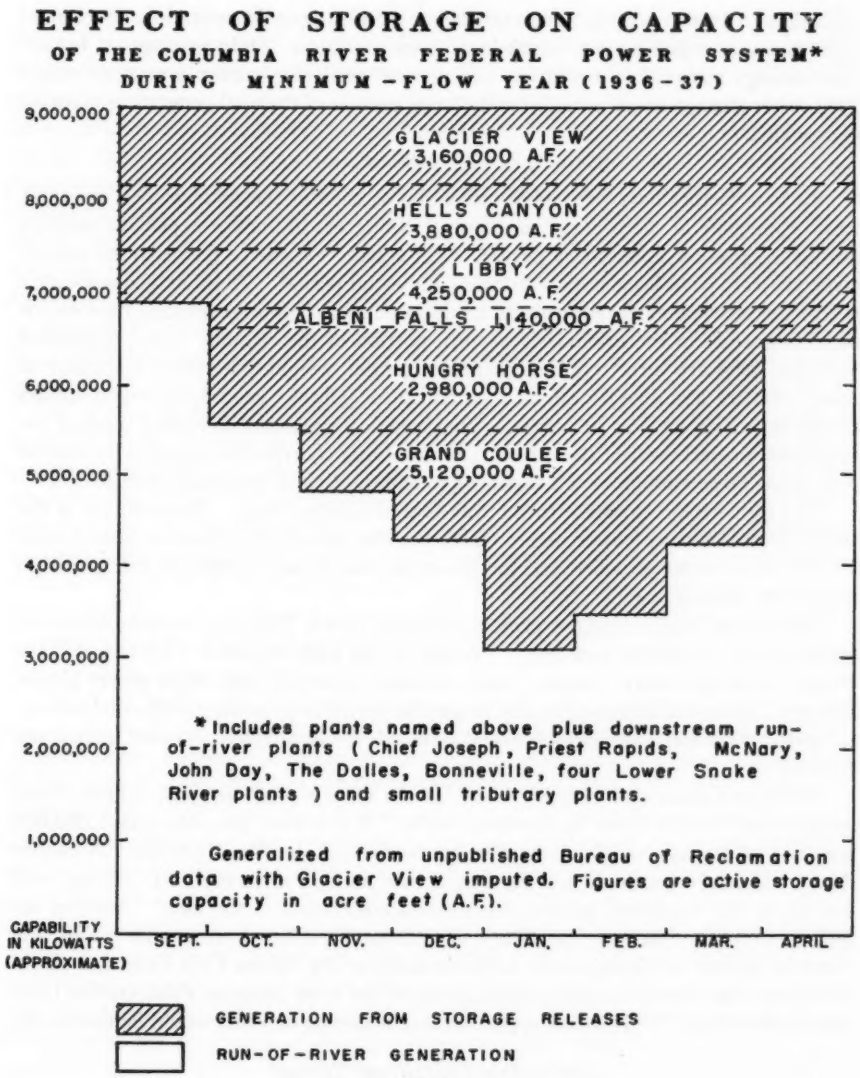

FIG. 2.

the rated capacity.[4] Interruptible power supplied under calculated risk contracts was shut off in early autumn. On November 17, a 10 per cent reduction in firm industrial power loads was ordered and the public was asked to make voluntary

[4] *Seattle Times*, Nov. 2, 1952.

reductions. Had the three unconstructed reservoirs been in operation, more than three times as much power would have been available. Only average or better-than-average streamflow conditions can prevent recurring winter power shortages until either storage or an unrealistically large amount of thermal generating capacity is provided.

Accomplished Upstream Storage

Various factors have prevented utilization of each of the undeveloped reservoir sites. One general factor is the reluctance of Congress to finance expensive projects during the present inflationary period. Yet equally expensive downstream run-of-river projects have been initiated during the same period. Another general factor is that the upstream storage projects are local political liabilities because their major benefits are felt in the urbanized, western portion of the region. Local opposition by a few who are directly affected carries greater weight than distant support of many who are less directly affected—a truism of political geography which applies to reservoirs as well as to tariffs. The specific arguments advanced against the individual projects reflect the difficulty of achieving coordinated resource utilization over areas large enough to cut across significantly diverse sectional interests.

The first major storage project was Grand Coulee Dam. Downstream is the series of run-of-river power plants which became financially attractive after Grand Coulee storage was provided and the power market of the Northwest had grown to its present dimensions.

The second major storage project, Hungry Horse Dam, in western Montana, stores nearly 3,000,000 acre-feet. Because of its high elevation (3,560 feet), the storage is exceptionally valuable; water released passes through eight power plants. Hungry Horse was endorsed locally as an alternative to providing additional storage in nearby Flathead Lake, which would have adversely affected summer homes and resorts.

Between Coulee and Hungry Horse is the third storage project, Albeni Falls, on the Pend Oreille River in northern Idaho. A low dam provides over 1,000,000 acre-feet of storage within natural water levels of Lake Pend Oreille. A higher dam could have been built, but the height was limited, in deference to strong local feeling, to the maximum natural water surface elevation of the lake. Another rejected alternative was the Boundary site, about 75 miles downstream. This site could have been developed to the same elevation as the Albeni Falls Dam and would have given the "most complete development of the river between Pend Oreille Lake and the boundary."[5] It was dropped because lead-zinc deposits would be inundated.

Undeveloped Upstream Storage

The three reservoir projects planned, but not yet started, are Libby, Glacier View, and Hells Canyon (Fig. 1). Together, they account for more than half of the planned system storage. These projects are not alternatives to each other, but have been selected from many alternatives to provide the aggregate storage considered necessary.

[5] *308 Report*, p. IV–40.

Libby Dam on the Kootenay River in northwestern Montana would create a reservoir extending several miles into Canada, storing 4,250,000 acre-feet or more. Expensive railroad relocation is required so that the project is feasible only if this expense can be pro rated over a large storage capacity. Therefore, the elevation cannot be limited to the elevation of the international boundary as was done at Grand Coulee. Because at least two Canadian sites would be inundated by the Libby Project, the necessary approval by the International Joint Commission has been withheld. The Canadian interests are in a strong position to press damage claims, if the Canadian sites are yielded, but again, the economics of the Libby Project would be jeopardized by excessive claims. Alternative sites downstream involve even more serious inundation problems. With some exceptions, local interests favor the project, desiring flood control on the troublesome Kootenay, apart from the power benefits. At present, the project is in abeyance pending international agreement.[6]

The second recommended reservoir site is Glacier View, in western Montana. One-third of the reservoir would be on lands in Glacier National Park. Some timberland would be lost, mainly second growth fir and lodgepole pine of modest scenic or commercial value. A significant amount of the best and critically limited winter range for deer and elk in the Park would be inundated. Park and wildlife interests have opposed the project vigorously, and the project has been deferred in deference to them. Apart from this problem, the Glacier View Project has very favorable relationships of costs to benefits because there is almost no existing development in the reservoir area and because the storage, like that of nearby Hungry Horse Project, would be at a high elevation (3,725 feet).

The third major reservoir not yet begun is the Hells Canyon Project, in the Grand Canyon of the Snake River on the Oregon-Idaho boundary. The dam would be approximately as high as Hoover Dam on the Colorado River, with a reservoir 90 miles long providing over 3,000,000 acre-feet of active storage. Water released would be utilized by three downstream plants existing or under construction and five other recommended plants.[7] Hells Canyon would add well over 1,000,000 kilowatts of prime (always available) power to the planned system, 688,000 at the site and 436,000 downstream.[8] Hells Canyon storage would provide almost complete control over the Snake River, the largest tributary of the Columbia. Of the major storage sites on this reach of the Snake, it is the farthest upstream, thus providing the maximum possible head. No significant settlements, railroad, or highway properties would be inundated. The site is upstream from the mouth of the Salmon River, one of the chief salmon spawning streams in the Columbia Basin, and would cause less damage to the salmon fishery than an otherwise attractive alternative

[6] In April 1953 the U. S. Department of State announced that the United States was withdrawing from further negotiations concerning Libby Dam.

[7] Bonneville (existing); The Dalles and McNary (under construction); and John Day, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite (recommended and authorized).

[8] Hells Canyon Dam. Hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, 81st Cong., 2d Sess., on H.R. 5743, 1952.

downstream, the Nez Perce site, which would block the Salmon River. The two projects, however, would be complementary rather than competitive; Hells Canyon would not interfere with ultimate construction of Nez Perce if the fish problem is solved. Between these two sites is a third, Mountain Sheep, which would be of comparable size and would not block the Salmon River, but would impinge upon and thus preclude construction of Nez Perce.

Development of Hells Canyon has been prevented by controversy which arose after the local private utility serving southwestern Idaho, the Idaho Power Company, announced plans to build five run-of-river plants in the proposed reservoir area, and applied for a license to construct one of them.[9] Construction of this plant would preclude construction of the Hells Canyon project. The issue has been generally described as one of private versus federal development, but it could be described with greater validity as full versus partial development, or regional versus local interest. The Idaho Power Company can and does operate with little storage because it uses streams of relatively high winter flows. It regularizes run-of-river power mainly by importing thermal-generated power from Utah. From a sequential point of view, a run-of-river system may be considered a first stage of hydroelectric development and storage plants a second stage. First stage development is adequate when market requirements are well below the available hydroelectric resources. As the market grows, stream regulation becomes both necessary and economic, and the second stage of development is entered. The Snake River has a relatively even flow, suitable for the first stage development adequate in southern Idaho. But the first stage is no longer adequate for more highly industrialized western Oregon and Washington. In this light, the conflict is sectional. Most of the support for the big project comes from other states, whereas the governor and most of the Idaho congressional delegation support local development.

Of the three unconstructed reservoirs, reasonable prospects for construction in the near future appear to exist for Libby only. Glacier View will undoubtedly remain in a status of indefinite deferment. In the instance of Hells Canyon, there is a definite possibility that the smaller-scale, local project will be licensed, thus precluding use of the Hells Canyon site for major storage.[10]

Alternative Storage Sites

Nondevelopment of the three important reservoirs would be less critical if satisfactory alternative sites were available to provide equivalent storage. Several alternatives—increased storage elevation at Flathead and Pend Oreille Lakes, the Boundary site, and Nez Perce—and the reasons for their rejection have already been indicated. Three other equivalent reservoir sites exist: 1) Paradise, on the Clark

[9] Later the company announced a modified plan calling for three dams, with approximately 1,000,000 acre-feet of storage at the uppermost. (Amended Exhibit Q, dated 10/28/52, of Idaho Power Company Application to Federal Power Commission for license on the Oxbow Project.) The license requested is not for the storage dam.

[10] Withdrawal of the Interior Department's opposition to this license application was announced May 5 by Secretary Douglas McKay. This is a policy decision of first importance.

Fork in western Montana, which could store 4,000,000 acre-feet, but would inundate four small communities, 9,000 acres of irrigated lands, Indian lands, a transcontinental rail line, and a highway; 2) the Springston site, on the Coeur d'Alene River in the Idaho Panhandle, which could provide 2,600,000 acre-feet of storage, but is strongly opposed because it would impede mining operations in the important Coeur d'Alene District; and 3) the Kooskia site on the Clearwater River in north central Idaho which could furnish 3,100,000 acre-feet of active storage, but is contested in Idaho because it would inundate four small communities and the route of a projected trans-Idaho highway. These alternatives—and others—were not selected for reasons which are at least as cogent as those which have prevented construction of the three recommended storage projects.

Thus, development of ten of the most favorable, large-scale storage possibilities, representing more than 34,000,000 acre-feet of capacity, is in a suspended status. The factors preventing action may be summarized as 1) economic, the inundation of urban, agricultural, and mineral development; 2) biologic, the conflict with fish migrations and winter wildlife range; 3) aesthetic, the conflict with recreational use of lakes and reservoir areas; and 4) political, the conflicts between local and regional points of view, private and public development, and American and Canadian interests. Physical factors, of course, are considered to be favorable or the projects would not have been recommended. Construction cost is important, but the demand for power in the Northwest and the willingness of Congress to undertake expensive nonstorage projects suggest that expense is not the critical factor.

POSSIBLE SOLUTIONS

Although the chances of obtaining adequate regulation of the Columbia seem poor at present, several steps might be taken to improve the prospects.

1. Assumption by local and state agencies of more responsibility for development might reduce the present overdependence on Congressional largesse and might overcome some obstacles, especially those of a political nature. Administrative machinery may be established whereby local interests can assume an appropriate share of both the authority and the responsibility for regional developments. Local public power groups are now exploring this possibility.[11] It is questionable, however, whether local interests can achieve concerted basin-wide action any more successfully than could federal agencies.

2. A better information program could be conducted. The role of upstream storage should be explained to the public in an objective manner as a basis for informed decisions.

3. Damages from upstream storage projects should be offset insofar as possible by generous severance and relocation allowances, and generous payments in lieu of local taxes.

4. The present at-site power rate has, with few exceptions, failed to attract significant industrialization to upstream areas. The at-site rate might be further low-

[11] *Seattle Times,* January 15, 1953.

ered to serve the intended purpose. Announcement of plans to construct an aluminum reduction plant near Hungry Horse dam has probably done more to make upstream storage attractive locally than all other measures taken to date.

5. The possibility of American financing of storage projects on the Columbia in Canada should be thoroughly explored. At least one Canadian site, Mica Creek, appears to be favorable. In view of the Libby experience, however, optimism over joint international action seems unwarranted.

If action were taken along lines similar to those suggested, progress might be made in the resolution of the storage problem. Lack of action, would raise the problem of alternatives to big reservoirs.

ALTERNATIVE PROPOSALS

The alternatives to adequate upstream storage are all of a considerably less attractive nature. In a region of rich hydropotential, they are, perhaps, even unsatisfactory. Each would require full inquiry. They may be listed, perhaps as a forecast, as follows:

1. Greatly increased thermal generation, by imported petroleum as at present, or by local low-grade coal. Thermal generation is more expensive and is not now fully competitive, but, if the desirable storage sites remain unavailable, it may become so.

2. Construction of a large number of small reservoirs, perhaps with small-sized, remote-controlled generating plants. This alternative has not been carefully studied, but casual attention has not been encouraging. It seems doubtful that such projects would provide an economic equivalent to major storage projects.

3. Curtailment of growth of the region's power requirements, an obvious but hardly palatable alternative. Such curtailment is in fact actually practiced now by present ceilings on new industrial loads. As a long-range measure, this would indeed be an anomaly in a region generally considered to have between one-fourth and one-third of the nation's hydroresources.

4. Further imports of energy. At present the region imports all the petroleum it uses, 90 per cent of the coal used, and some electric power. Natural gas will probably be imported in the near future. A proposal has even been advanced recently to generate large quantities of thermal energy in the Crowsnest area of British Columbia and Alberta for sale to the Pacific Northwest.

5. Reliance on early development of low-cost atomic, solar, or other energy sources, advocated only by the more optimistic. Conservative scientists as yet are unwilling to predict obsolescence of hydropower in the foreseeable future.

In summary, two decades after the decision to start construction of Grand Coulee Dam—the first major effort to control the Columbia River—the further development of the Columbia River power potential is in question. In spite of the many favorable engineering and economic factors, social, political, resource, and regional conflicts pose difficulties which are extremely serious if not actually insurmountable.

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FRANCE AND "LES LIMITES NATURELLES" FROM THE SEVENTEENTH TO THE TWENTIETH CENTURIES

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AN earlier paper has reviewed the development during the Middle Ages of the idea that the Kingdom of France had "natural frontiers" which it was her right, even her duty, to attain. No political policy, based on this conception, was ever pursued consistently, and it is very doubtful indeed whether it was at any time even of significant political importance.

During the period of most vigorous and most enduring territorial expansion of the French state, the reigns of Louis XIV and XV, no appeal seems to have been made to this "doctrine." French territorial conquests were justified either on simple strategic grounds, or on grounds of inheritance and feudal right. That painstaking collector of epigrams relating to the subject, Albert Sorel, has found nothing to his purpose from the pens of French writers and politicians of this period. Nevertheless, there was some deep thinking on the subject of natural frontiers during these years.

THE AGE OF REASON

In 1748, Montesquieu published his *Esprit des Lois,* a study of the theoretical basis of the law of peace and war and of the principles of social responsibility. He accepted the tenets of "natural law," that is of the body of precepts deriving from no statutory law and often enough not enforceable by any court, but based upon reason. In the medieval concept, statute law had to be in accord with natural law or it was, in the words of St. Thomas Aquinas, "a mere perversion of law." Natural law was held to derive from the highest authority: in the middle ages from God; in the seventeenth and eighteenth centuries, from Reason.

Attack and conquest, in the view of Montesquieu, are permissible only if their object is self-defense: "la loi de la nature, qui fait que tout tend à la conservation des espèces."[1] These elementary rights of self-preservation belong, not only to human beings, but also to man as organized in the State. Warfare to preserve the integrity of the State is lawful, even laudable; so also is a preventive war, if, by failing to wage war, an even greater threat to the State may develop. It thus follows that conquest for its own sake is contrary to natural law, and Montesquieu denounces the conquests of the Swedish King, Charles XII, which, in his opinion, had no other motive than Charles' inordinate pride.[2] The problem of determining whether a particular act of conquest is motivated by the need of self-defense, and thus al-

[1] *Esprit des Lois,* X, 3. In the facsimile edition of André Masson, which has been used here, p. 184. Paris 1950; see also John Locke, *An Essay concerning the true Original Extent and End of Civil Government,* 1690, Chapter 2.

[2] Montesquieu, X, 13.

lowable within the terms of natural law, or inspired by greed, pride, or similar motive, and thus outside the sanction of law, is clear to Montesquieu.

Each state has *"limites naturelles."* To defend these *"limites"* is right and proper; to annex territory outside them is to offend against natural law. A state may conquer and expand only up to these *"limites naturelles."*[3] If in the course of a military campaign it should prove necessary to exceed these limits, then the conquered population should be treated with extreme deference, for they belong legitimately to another state. Law and custom in the conquered territory should in no way be altered. Such conquest should be regarded as temporary and justified only in so far as it is necessary for the preservation of the state which makes it.[4]

Locke used a similar argument in his *True End of Civil Government.* Only defensive wars are in accord with the law of nature. No state has rights outside its own boundaries, and even when attacked may take punitive action only against those directly responsible for the aggression. Lasting conquest outside the boundaries of the State is wrong. Locke, however, offers no suggestion on how the legitimate frontiers may be determined.[5]

In earlier centuries appeal to *les limites naturelles* in France had been based on historical argument. And historical arguments, with or without express reference to the Rhine frontier, continued to be published until the middle of the seventeenth century.[6] But in the eighteenth century appeal is made only to natural law, to an authority higher than history. This contrast of necessity carries another with it. The early claims, based on history, were specific; the frontier was precisely located. But natural law prescribed only a respect for *limites naturelles* as such; it gave no rules for their identification. Neither Montesquieu, nor Locke, nor, at a rather later date, Rousseau ever attempted to define on the map those natural limits which they advocated.

If the historical argument of an earlier period had in all probability very slight practical importance, the argument from natural law may be said to have had none. It was too vague, too philosophical, too idealistic, and susceptible of too great a variety of interpretations to carry over into the sphere of diplomacy and politics.

This idea that Nature has prescribed territorial limits to the state was not only expressed by Montesquieu and rather less definitely by Locke.[7] Turgot mentioned[8] the obligation of the State to confine itself "to the bounds which Nature has given it." But the fullest statement, after Montesquieu, was offered by J-J. Rousseau: "Just as nature has set limits to the growth of a well formed man . . . , so, too,

[3] *Ibid.* X, 9.

[4] *Ibid.* X, 9, p. 192.

[5] Locke, *op. cit.*, Chapter XVI, cap. 175–196.

[6] Among works of this kind, not cited in the earlier paper, may be mentioned Père Labbé, *Testamentum christianum, Testamentum politicum,* Lyon 1643; and L. Chantereau-le-Febvre, *Question historique, si les Provinces de l'ancien royaume de Lorraine doivent estre appellées terres de l'Empire,* Paris 1644.

[7] Locke, *op. cit.*, Ch. XVI.

[8] A.-R.-J. Turgot, *Oeuvres complètes,* ed. Schule. I. pp. 327–8.

there are limits of extent outside which a State cannot have the best possible constitution. It must be neither too large to make good government impossible, nor too small to defend itself unaided."[9] A State of small territorial extent, he argued, is likely to be stronger than one larger, because distance increases the difficulties of administration, and a large State is likely to have an exaggerated bureaucratic structure. The State should be internally stable; it should not embrace too great variety of law and custom, of climate and physical environment. "The ideal is achieved when the land can support its population, and when the population is of a size to absorb all the products of the land."[10] A large and economically undeveloped area on the one hand; a dense population and dependence on outside sources for certain commodities on the other: each places a state in a weak defensive position.

Rousseau argued further that as each state was set in a natural or physical framework, the number of states was necessarily limited. "The lie of the mountains, seas and rivers which serve as frontiers for the various nations who people it (i. e. Europe), seems to have fixed for ever their number and their size. We may fairly say that the political order of the continent is, in some sense, the work of nature."[11]

Rousseau refused to lay down any arbitrary rules regarding the size of the State, recognizing the many variable factors of soil, climate, and "temperament" of the people.[12] Lastly, he recognized that "it will be found that the natural peculiarities of a land make it allowable, or even necessary, to set its frontiers wider than might at first seem desirable." He specified, in particular, the possible need to add territory into which population might migrate from densely populated areas, such as mountains where the birth-rate is high and the natural resources restricted.[13]

Rousseau, then, conceives the territory of a state to be of such size that its administration presents no geographical problems, that it is as nearly self-sufficing as possible, and that it is so laid out that its defense offers as little difficulty as possible. Like Montesquieu and Locke, Rousseau made no application of his theories.

THE REVOLUTIONARY PERIOD

It was not until the Revolutionary Wars of the last years of the eighteenth century that any practical exemplification was given to the doctrines derived during the preceding century from the law of nature. The very vagueness of this law led to a variety of interpretations, and the circumstances of the French Revolution were not calculated to produce that rational approach to the question which the *illuminés* of the eighteenth century had presupposed.

[9] *Contrat Social*, 1762, Bk. II, Ch. 9, World's Classics edition, *Social Contract: Locke-Hume-Rousseau*, Oxford University Press, used here.

[10] Rousseau, II, 10. This is an interesting anticipation of J. G. Fichte's *Der geschlossene Handelstaat*.

[11] Extrait du projet de paix perpetuelle de M. l'abbé de Saint Pierre, written 1756, in C. E. Vaughan, *The Political Writings of Rousseau* (Cambridge, 1915) Vol. I, 365–387. The translation used is that given in Elizabeth York, *Leagues of Nations: Ancient, Medieval and Modern*, London, 1919, pp. 154–178.

[12] Rousseau, II, 10.

[13] *Loc. cit.*

The Revolution had begun with the meeting of the States General in June, 1789. Its revolutionary activities and the restrictions which it imposed on King Louis XVI antagonized other European rulers. These declared their hostility to the new regime in France in 1791, and in April 1792 France declared war on the Kingdom of Prussia and Empire of Austria. After initial defeats, the French first held the invaders and then occupied Belgium, Savoie, and Nice in 1792.

The revolutionary government was now obliged to face the question of its boundaries. The question whether to annex these occupied territories to France was discussed in the National Convention. In each of these territories was a body of opinion sympathetic to France. In Belgium, indeed, there had previously been an unsuccessful rebellion against the Austrian rulers of that country, and a desire to become part of France was expressed in Savoie. In this context the ex-abbé Grégoire made a speech in the National Convention.[14]

"Before considering whether you should, in accordance with the freely expressed wish of Savoie, incorporate it in the French Republic, you should consult the Law of Nature and see what it permits and requires in this respect" (*... compulser les archives de la nature, voir ce que le droit vous permet, ce que le devoir vous prescrit à cet égard ...*). He goes on to repeat, almost in the words of Rousseau, that too great and varied a territory raises administrative difficulties and leads to an excessive concentration of political power in a few hands. He illustrated his argument, pointing out the difficulties that would arise if France were to "expand beyond Lake Geneva, the Mont-Cenis or the Pic du Midi" (in the Pyrenees). In such a striving after mere size France would find a source of weakness and decay. And then: "France is a unit, sufficient to itself, since all around nature has given it limits which make expansion unnecessary. Thus our interests are in agreement with our principles."[15]

May France, in terms of natural law, absorb Savoie? This law answers, yes. "All relations, physical, moral (*moraux*) and political require this union. Piedmont, within the Po basin and east of the Alps, has vainly tried to include Savoie, but "ceaselessly the Alps have been forcing it into the realm of France, and the natural order would be violated if France and Savoie were not united."[16]

The logic of the French case for annexation of Savoie was firmly based on the eighteenth century teachings of natural law. Grégoire was not the only person to argue thus. The more illustrious Condorcet described the natural unity of France.[17] Carnot, speaking in the National Convention on the incorporation of Monaco and certain small territories which now form part of the Saarland, laid down the axiom

[14] *Le Moniteur*, XIV, 1792, issue for 28th November, pp. 585–587. Translation by the author.

[15] "La France est un tout qui se suffira elle-même, puisque partout la nature lui a donné des barrières qui la dispensent de s'agrandir, en sorte que nos intérêts sont d'accord avec nos principes." *Ibid.*, p. 587.

[16] Sans cesse les Alpes repoussent celle-ci dans les domaines de la France, et l'ordre de la nature serait contrarié si leur gouvernement n'était pas identique." *Ibid.*, p. 587.

[17] *Le Moniteur Universel*, 17 Feb. 1793, pp. 221–4.

that natural law prescribes that the State is primarily obligated to defend itself.[18] It follows that no territory may be added or frontiers altered voluntarily unless the change increases the security of the state. He added that the annexation of territory should be made only with the acquiescence of its inhabitants. Carnot went on to say that the line up to which the French might legitimately expand, beyond which they should not, by the terms of natural law, extend their boundaries, were *"les limites anciennes et naturelles de la France . . . le Rhin, les Alpes et les Pyrénées."* Territory within these limits not then in the possession of France had been "usurped." Carnot's argument then became specific as to the case of Monaco. He mixed arguments drawn from physical geography and from history, but his case clearly depended on his own and his listeners' acceptance of the principles derived from natural law that had already been expressed. The admission of Belgian territories was similarly justified during the following weeks.[19]

It was difficult to preserve a judicious air in assessing the merit of such territorial claims. Natural law lacked precision; there was, as Carnot emphasized, no court of appeal, and natural law could be construed as permitting any act conducive to national strength or well-being. Other speakers were more forthright than Carnot[20] or the judicious Grégoire. Lasource merely desired to put the barrier of the Alps between France and the "despot of Turin."[21] Ducos mildly suggested that too wide an extension of the boundaries might weaken France,[22] but Danton crushed all such objections with his sweeping assertion that "The boundaries of France are marked out by nature. We shall reach them at their four points, the Ocean, Rhine, the Alps, the Pyrenees."[23]

The view of Danton gained ground with the growing power of the extremists at Paris. The diffidence—some would say hypocrisy—of Grégoire and Carnot disappeared. Territorial expansion was justified by the immediate needs of France.

In 1795, the coalition that had been formed against France began to break up. In the discussion of peace terms the security of France from invasion became a leading issue.[24] Already opinion had been hardening in favor of occupying the line of the Alps and Rhine.[25] Its military advantages were clear. Merlin de Douai pointed out to the National Convention that a line of fortresses had not in 1792 saved France from invasion; perhaps the river Rhine would be more successful:

[18] *Le Moniteur Universel,* 17 Feb. 1793, p. 220.

[19] *Le Moniteur Universel,* 2 March, 1793, p. 283; 4 March, p. 292; 5 March, p. 296; 8 March, p. 307; 10 March, p. 315; 11 March, p. 320.

[20] See Hippolyte Carnot, *Mémoires sur Lazare Carnot 1752–1823.* Paris 1907. Vol. I, pp. 299–304, and *Correspondence générale de Carnot.* ed. Etienne Charavay, Paris 1897. Vol. IV, letter 712, p. 709.

[21] *Le Moniteur Universel,* 1 Feb. 1793. No. 32.

[22] *Ibid.*

[23] *Ibid,* and Albert Mathiez, *Danton et la Paix.* Paris 1919. p. 65.

[24] See Albert Sorel, "Les Frontières constitutionelles, 1795," *Revue Historique,* XIX (1882): 21–59.

[25] See *Papiers de Barthélemy,* ed. J. Kaulek. Paris, 1886. Vol. I, p. 474; *J. P. Brissot, Deputy of Eure et Loire to his Constituents* (translation). London, 1794. p. 71.

"There is assuredly no one amongst us who does not hold unswervingly to the profound truth, often proclaimed in this tribunal and always received with the widest acclamation, that the security of the Republic and the peace of Europe are closely bound up with the extension of our territory to the Rhine."[26]

By the Treaty of Basel of April, 1795, France secured from Prussia a recognition of her boundary on the Rhine. The war with Austria dragged on until 1797, when, by the Treaty of Campo Formio, the Rhine boundary was recognized also by the Austrian Emperor. So far we have seen merely the implementation of an argument regarding boundaries, drawn from natural law. Admittedly the interpretation was onesided and, in the hands of Germans or Italians, natural law could be made to justify a very different boundary and one much less favorable to France. An anonymous writer in England commented in 1795 on the French claim:

"The French answer . . . that Nature has pointed out the Alps, and the course of the Rhine and of the Lower Meuse, as the eastern and northern boundaries of the French empire: if by nature it meant Providence . . . there is neither religion, nor sense, nor modesty, nor morality in such a pretension; it might with equal propriety be said, that nature has pointed out the Baltic and the borders of Siberia."[27]

We need not concern ourselves with boundary changes made during the next twenty years. They were merely opportunist, made in the light of a rapidly changing military and political situation. They were steps in the war with England, and their frequency was such that no one could possibly have regarded them as permanent or paused to debate on what philospohical concept they could have been predicated.

It is, however, significant that in all the discussion of boundaries that took place during the Revolutionary period, the argument drawn from history was rarely mentioned and never pursued. The logical basis of French claims was the law of nature.

THE NINETEENTH CENTURY

The abortive Treaty of Paris of May, 1814, gave France as her eastern limits, the boundary which she had possessed in 1792. She would thus have retained certain small enclaves within her territory as well as Savoie and a part of the present Saarland. The return of Napoleon, the "Hundred Days," and his defeat at Waterloo made the European powers more intransigeant. By the second Treaty of Paris of November 1815 the territory of France was reduced to its limits of 1789, though enclaves, such as Avignon and the Venaissin were retained.

In the opening decade of the nineteenth century a new doctrine of frontiers had been propounded, not in France, but in Germany. In 1807 J. G. Fichte delivered

[26] "Merlin de Douai to the Convention Nationale, on Oct. 8, 1795," *Le Moniteur Universel*, XXVI (1795): 121–2.

[27] *Some Remarks on the Apparent Circumstances of the War, in the fourth week of October 1795.* London, 1795. p. 49.

his *"Addresses to the German Nation."*[28] He asked whether there was a German nation; whether it was worth preserving and whether it could be preserved. These might have seemed open questions in the year following the Prussian defeat at Jena. Under the eye of the French authorities, Fichte claimed that:

"wherever the German language was spoken, everyone who had first seen the light of day in its domain could consider himself as in a double sense a citizen, on the one hand, of the State where he was born, and to whose care he was in the first instance commended, and, on the other hand, of the whole common fatherland of the German nation. . . ."[29]

"Those who speak the same language are joined to each other by a multitude of invisible bonds by nature herself, long before any human art begins; they understand each other and have the power of continuing to make themselves understood more and more clearly; they belong together and are by nature one and an inseparable whole."[30]

Then, as conclusion to this argument: "it is not because men dwell between certain mountains and rivers that they are a people, but, on the contrary, men dwell together—and, if their luck has so arranged it, are protected by rivers and mountains—because they were a people already by law of nature which is much higher,"[31] that is, in virtue of a common language and culture. Thus Fichte has replaced the shaky logic of the French with a vague mysticism about *Volk*.

Such thinking was not altogether new. In the closing years of the fifteenth century and early in the sixteenth, the German humanists showed a considerable, though academic, interest in the boundaries of the German language area.[32] Hermann Conring in the seventeenth century had hinted at a definition of Germany in terms of the language boundary,[33] and among the immediate precursors of Fichte was Herder who was instrumental in developing an interest in German language, folklore and local history.[34]

[28] *Reden an die deutsche Nation;* the translation by R. F. Jones and G. H. Turnbull, Chicago, 1922, is used here.

[29] *Ibid.*, p. 147.

[30] *Ibid.*, p. 224.

[31] *Ibid.*, pp. 224–5.

[32] See especially *D. Jodoci Willich Reselliani, in Cornelii Taciti Equitatis Romani Germaniam Commentaria,* an edition of 1610 used: Beatus Rhenanus, b. 1485, *De Rebus Germanicis,* an edition of Strasbourg 1610 used; Wimpheling, *Germania ad Rempublicam Argentinensem,* 1501; also L. Gallois, "Les Géographes allemands de la Renaissance," *Bibliothèque de la Faculté des Lettres de Lyon,* XIII (Paris 1890); Charles Schmidt, *Histoire Littéraire de l'Alsace* (Paris 1879), N. J. G. Pounds, in *Annals of the Association of American Geographers,* XLI (1951): 154–5.

[33] *De Germanorum Imperio Romano,* 1643, and *De finibus Imperii Romano-Germanici,* 1654. On the patriotic writings of Conring, see E. von Möller, *Hermann Conring der Vorkämpfer des deutschen Rechts* (Hannover, 1915) and Erik Wolf, *Grosse Rechtsdenker der deutschen Geistesgeschichte* (Tübingen, 1939).

[34] See R. O. Butler, *The Roots of National Socialism, 1783–1933.* London, 1941. pp. 23–65.

But French expansion to the Rhine was welcomed by not a few Germans at this time. They were chiefly Rhinelanders; some were young, hotheaded enthusiasts for the Revolution as such, some had been "bought" by France, but most were more or less influenced by a personal hatred of Prussia. In their most extreme utterances they outdid even Danton. By 1815 most had been forgotten, and some, like "Turnvater" Jahn, had turned from being slavish admirers of France into the most rabid German patriots.[35]

In the generation following 1815 the intensification of German nationalism was accompanied by popular demands that the western boundary of Germany should accord with the limits of the German tongue. Arndt published in 1813 a tract in which he mixed the history of the German Empire with the geography of the language frontier. "What are, he asked, the natural frontiers (*Naturgrenze*) of peoples (*Volkes*). I say that language constitutes the only truly valid natural frontier. God has created the differences between languages. The different languages constitute the natural divisions between peoples and lands" (*Völker und Länder*).[36]

In 1841, Helmuth von Moltke wrote on the "Western Frontier Problem" in similar terms.[37] Writings increased both in number and in the violence of their tone. In 1861, Johannes Janssen produced a particularly scurrilous pamphlet,[38] which evoked a studied rebuke in the *Historische Zeitschrift*.[39] During and after the War of 1870 the outpouring of this literature reached its peak, and was then quieted by the at least partial satisfaction of German ambitions.[40]

The production of this voluminous literature was accompanied by the publication of ballads that had an even wider currency. In 1840, a year of particularly strained relations between France and Prussia, Nikolas Becker produced *"Der deutsche Rhein,"* with its refrain, addressed to France:

Sie sollen ihn nicht haben,
Den freien deutschen Rhein.[41]

[35] See Joseph Görres, "Teutschland und die Revolution (1819)," *Gesammelte Schriften* IX (1854–74), English translation, London, 1820; Georg Forster, "Ueber das Verhältniss der Mainzer gegen die Franken," *Sämmtliche Schriften,* VI (Leipzig, 1843): 413–431; Selma Stern, "Anacharsis Cloots, der Redner des Menschengeschlechts," *Historische Studien, 119,* Berlin, 1914. A general survey of the activities and writings of these people is given in G. P. Gooch, *Germany and the French Revolution* (London, 1920). Even Heinrich Heine was not free from a certain nostalgic attraction to the French occupation of the Rhineland.

[36] E. M. Arndt, *Der Rhein, Deutschlands Strom aber nicht Deutschlands Grenze,* 1813, edition of 1921 (München) p. 9. Author's translation.

[37] Helmuth von Moltke, *Gesammelte Schriften,* II (Berlin 1892): 171–228.

[38] Johannes Janssen, *Frankreichs Rheingelüste und deutsch-feindliche Politik,* 1861.

[39] W. Maurenbrecher, in *Historische Zeitschrift,* VII (1862): 230–234.

[40] Particularly interesting was a collection of letters: *Letters on the War between Germany and France,* by T. Mommsen, D. F. Strauss, F. Max Müller and T. Carlyle (London, 1871); also Heinrich von Treitschke, *Was fordern wir von Frankreich* (Berlin, 1870).

[41] Many of these patriotic ballads are published in *Deutsche Literatur,* Reihe *Politische Dichtung* Band 3, *Um Einheit und Freiheit 1815–1848,* ed. Ernst Volkmann.

Later in the same year Max Schneckenburger produced his even more familiar ballad, *Die Wacht am Rhein,* and in the following year the *Deutschland über Alles* of A. H. Hoffmann von Fallersleben expressed the longing that:

> Von der Maas (Meuse) bis an die Memel
> Von der Etsch (Adige) bis an den Belt—
> Deutschland, Deutschland über alles,
> Über alles in der Welt.

This phase passed. Five years later the balladmongers had turned their art against Denmark, and were adding their poetic flame to the burning question of Holstein and Schleswig.

At the same time an increasing interest began to be shown in the cartographic representation of the language frontier. Its survey was a necessary prelude to the formulation of specific claims. The first careful attempt to trace the western limits of German speech, so far as the writer is aware, was made in 1844 by Nabert and published in 1852 by Heinrich Berghaus.[42] A few years later Nabert published a map with accompanying memoir of his own[43] and in 1867, a further and revised edition.[44] The latter map contained a representation of the extreme limits which the German had ever reached. Through the pages of Justus Perthes' *Mitteilungen*[45] it reached a wide public. It distinguished what it termed *reine deutsche Gebiete* (purely German areas) from the *gemischtes Gebiet* (area of mixed speech). These claims were widely drawn, and the only part of the language frontier with any pretensions to accuracy was the line which followed the Vosges from Münstertal to the Ballon d'Alsace.

In 1874 Kiepert published a map which at last could claim to be authoritative.[46] In the following year, Kiepert's map, somewhat simplified, was published in the Mitteilungen.[47] Kiepert distinguished the areas of German speech from those of mixed French and German and showed what purported to be the extent of the German tongue in the seventeenth and eighteenth centuries. The first and second it represented with a tolerable degree of accuracy and the last with some exaggeration. The present course of the linguistic boundary north of Switzerland has more recently been examined in the scholarly works of Godefroid Kurth and Constant This.[48]

[42] Heinrich Berghaus, *Physikalischer Atlas,* second edition. Gotha, 1852.

[43] Nabert, *Ueber Sprachgrenzen, insonderheit die deutsch-französische.* Hannover, 1856.

[44] Nabert, *Specialkarte der deutsch-französischen Grenzländer, mit Angabe der Sprachgrenze.* Berlin, 1867.

[45] *Petermanns Mitteilungen,* XVI (1870): Tafel 22.

[46] H. Kiepert, "Die Sprachgrenze in Elsass-Lothringen," *Zeitschrift der Gesellschaft für Erdkunde zu Berlin,* IX (1874): 307–316 and Tafel IV. In 1871, Kiepert had, with R. Boeckh published an *Historische Karte von Elsass und Lothringen* (Berlin) in which the present language boundary was shown.

[47] *Petermanns Mitteilungen,* XXI (1875): Tafel 17.

[48] G. Kurth, *La Frontière linguistique en Belgique.* Brussels 1896; Constant This, "Die deutsche-französische Sprachgrenze in Lothringen," *Beiträge z. Landes- und Volkeskunde von*

Boeckh, writing in 1869, was evidently still disturbed by the older argument of "natural frontiers." He defined the *Naturgränze Deutschlands* as "the watershed between the Rhône and Rhine systems; between the upper Moselle-Meurthe and the Vesouze; the Seille and the Saar; the French Nied and the German Nied; between the upper Moselle-Orne and the lower Moselle-Meuse. . . ."[49] He then calculated the number of Germans west of this line, together with the area they inhabited, and the number of the French-speaking population to the east, along with their area. These "minorities" he found to be small and approximately equal (31,286 Germans on the French side and 38,103 French on the German side). Boeckh seems to have derived some satisfaction in using this somewhat tendentious argument to show how "natural" as well as language boundaries conspire in favor of the territorial claims of the German *Reich*.

THE FRENCH REPLY

The Culture Area

German claims in the nineteenth century which, it should be emphasized remained in the nature of propaganda and were never raised in their entirety at the diplomatic level, were based upon language. German writers assumed that national sentiment would accord with linguistic affiliation.[50] The French were not slow in answering this German claim. We may dismiss as irrelevant the French poets who replied in poems of a distinctly higher quality to the vulgar ballads of the Germans.[51] The French argument is that a common language is not the only nor even an essential criterion of nationality. Fustel de Coulanges will serve as exponent of the French viewpoint; he was one of the most distinguished as well as eloquent. He replied to the assertions of the German historian, Theodor Mommsen:[52] "I am astonished that a historian like yourself should pretend not to know that it is neither race nor language that makes a nation . . . what marks out a nation is neither race nor language. Men feel it in their hearts that they are a single people when they have in common thoughts and interests, affections, remembrances and aspirations."[53] The Alsatians were made French not by the act of military conquest, but by sharing in the creative achievement Revolution and of the Napoleonic era. The tongue they speak is irrelevant.[54]

Elsass-Lothringen, I (Strasbourg, 1887), and "Die deutsche-französische Sprachgrenze in Elsass," *Ibid*, I (1888). See also H. Gaidoz, "Des Travaux des Allemands sur la Géographie des Langues en Alsace et en Lorraine," *Revue des Questions Historiques*, XVI (1874): 228–235.

[49] R. Boeckh, *Der deutschen Volkszahl und Sprachgebiet in den europäischen Staaten*. Berlin, 1869. p. 291. The figures are given in Table IX, pp. 300–301.

[50] See Fichte, *Reden*, p. 223–4.

[51] Foremost amongst these is A. de Lamartine's dignified *La Marseillaise de la Paix*, written in 1841 in answer to Becker. Béranger, Châteaubriand, and Victor Hugo also wrote on this topic. A number of quotations is given in Louis Madelin, "Le Rhin français," *Revue des Deux Mondes*, XLVIII (1918): 485–523.

[52] The writing of Mommsen in question may have been the letter cited early, footnote 40.

[53] Fustel de Coulanges, *Questions Historiques*, ed. C. Jullian. Paris, 1893. This is a collection of papers published posthumously. The quotation is from pp. 507–509.

[54] See also Henri Hauser, *Le Principe des Nationalités*. Paris, 1916.

The Modern Phase

In 1870, Prussia attacked France, and by the Treaty of Frankfurt of 1871 annexed Alsace and part of Lorraine. There is every reason to believe that the new boundary was demarcated by the Germans in accordance with their linguistic and strategic demands.[55] They took, as a matter of fact, more territory than was justified by their own argument drawn from language. In 1919 this territory was returned to France. At this time French thought on the subject of the Franco-German frontier was confused. Every argument of the previous four hundred years was raised at a diplomatic level, in the press, and in monographs and brochures. In the past, an approximate equality in military strength between France on the one hand and the German Confederation or Empire on the other, had made the question of France's expansion to the Rhine one of pressing political significance. Now, however, France was so eclipsed in terms of military and economic strength by her eastern rival that the question of French aggression can scarcely be said to have existed. French policy from 1918 onwards was avowedly defensive. The issue was how best to secure France from renewed invasion and spoliation.

The question of the Rhine frontier was indeed raised but only because it was thought in some quarters that it alone presented an easily defended barrier against the Germans. The French fear of a third invasion of their country by the Germans deserved respect, but to satisfy it by granting Germany west of the Rhine would have been to violate the "principle of nationalities," so dear to most of the peacemakers in 1919.

Foch formally demanded that the Rhine be made France's eastern boundary, presumably along its whole course from Basel to the Dutch border.[56] Such a plan was acceptable to no one except the French. Less unrealistic was the proposal, put forward by the French in secret negotiations with the Russians early in 1917, for the establishment of a Rhineland Republic covering German territory between the Rhine on the east and France and Belgium on the west. This also was discouraged in American and British quarters.[57] In the end the French gained no extension of territory, and Germany lost only Eupen and Malmédy and, temporarily, the Saar Territory. French thought on the subject of the eastern boundary was dominated unquestionably by considerations of military power and defensive strategy.

SUMMARY AND CONCLUSIONS

Within the past four centuries, French thought regarding the alignment of the eastern boundary of France is divisible into four periods. The first, or early modern, was dominated by an historical approach. A boundary was required to have the sanction of historical precedent. The right of conquest was itself invalid unless sup-

[55] R. Hartshorne, "The Franco-German Boundary of 1871," *World Politics,* II (1950): 209–250.

[56] See R. S. Baker, *Woodrow Wilson and World Settlement.* London, 1923. Vol. II, pp. 9–10.

[57] *The Intimate Papers of Colonel House,* ed. Charles Seymour. London 1928. Vol. IV, pp. 345–370.

ported by the argument of history or by right of inheritance, itself proved from history. When in 1681, Louis XIV annexed Strasbourg, it was only after a court of law (the *Chambre de Réunion*) had proved to the satisfaction of its own far from exacting conscience that the city belonged in law to the king.[58]

The second period is divisible into two phases. During the first, which occupied all except that last decade of the eighteenth century, a rough theory of *"limites naturelles"* evolved from the current concept of natural law. In the second, this theory proved to be a weapon in the armory of the French Revolutionaries, used at first hesitatingly and with some respect for Reason which had inspired it; then with increasing recklessness until it became merely a means of justifying aggression.

The third period, the nineteenth century, was characterized by, first, the German appeal to language or "race" as the basis of territorial division between states, and, secondly, by the French reply that the nation is made up of people bound together by ties of history and culture. The French acceptance of the neutrality of Belgium, in the Treaty of London of 1831, removed the Low Countries from the sphere of any possible French territorial claim. The French tacitly dropped the claims previously made to all territory west of the Rhine,[59] but argued that Alsace and German-speaking Lorraine are French in virtue of "feeling French" and being part of France during a formative period in their history.

The military strength of the German *Reich* casts its shadow over the fourth period. While never abandoning that stand which they took in the nineteenth century, the French now insist on security.

Only during the revolutionary wars did events keep pace with theory. At other times the extent of France fell short of her historical claims, or differed from that which reason would prescribe. From 1871 to 1919 claims to Alsace-Lorraine were kept before the public, and, though these were satisfied in the Treaty of Versailles, the official and unofficial claims made in the interests of security were left unsatisfied.

[58] A. Legrelle, *Louis XIV et Strasbourg*. Paris, 1884.

[59] A partial exception to this is the French complaint that the boundaries of 1815 were those of 1789 rather than those of 1792; The Emperor Napoleon III, imitating his great uncle's example, rashly claimed considerable areas of non-French territory, but it does not appear that in this he was supported by more than a small section of French opinion: See Hermann Oncken, *Die Rheinpolitik Kaiser Napoleons III von 1863 bis 1870 und der Ursprung des Krieges von 1870–1*. 3 vols, Berlin 1926. There can be little doubt, in the light of the documents cited in volume III that the Germans were convinced that the French still cherished designs on the Rhine boundary. See also the comments on this subject by Persigny in *Mémoires du Duc de Persigny*, ed. Comte d'Espagny. Paris, 1896. pp. 330–333.

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THE TERM "BAYOU" IN THE UNITED STATES: A STUDY IN THE GEOGRAPHY OF PLACE NAMES*

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INTRODUCTION

AN astonishing volume of material has been published on place names in the United States. But when one examines this abundance one is impressed by the fact that practically all of the serious place-name studies have been done by philologists from a linguistic point of view; few of these studies have been done by geographers, or from a geographic point of view.[1]

Place names may be considered as significant in the cultural landscape as are house types, field patterns, or modes of transport. From this point of view, the classification and distribution of place names is as much in the field of geography as the etymology of these terms is in the field of philology. Moreover, place names are persistent cultural traits, the character and distribution of which may indicate the spread of people and ideas at various times. It is well known that European geographers and historians have long employed place names as aids in tracing human migrations and even in reconstructing the former vegetation cover of certain areas.[2]

For the geographer and historian one of the most significant aspects of place-name study involves the origin, spread, and present distribution of the generic parts of toponyms. Generic terms dealing with physical features in the United States, such as brook, run, butte, and hollow, are generally the more meaningful parts of geographic names, for they are durable language forms, originally associated with definite culture groups. The same can be said for generic terms that deal

* This paper was read before the Association of American Geographers, April, 1953.

[1] See *Bibliography of Place Name Literature: United States, Canada, Alaska, and Newfoundland,* ed. by R. B. Sealock and P. A. Seely. Chicago, 1948. The few serious place-name studies that are geographically oriented include R. H. Whitbeck, "Regional Peculiarities in Place Names," *Bulletin of the American Geographical Society,* XLII (1911): 273–281; G. D. McJimsey, *Topographic Terms in Virginia,* American Speech Reprints and Monographs, no. 3, Columbia University Press, 1940 (See especially the Introduction, pp. 1–38); A. H. Meyer and N. Baumeister, "Toponomy in Sequent Occupance Geography: Calumet Region," *Indiana Academy of Science Proceedings,* LVI (1945): 142–159; H. F. Raup, "Place Names of the California Gold Rush," *Geographical Review,* XXXV (1945): 653–658. H. F. Raup and William B. Pounds, "Northernmost Spanish Frontier in California as Shown by the Distribution of Geographic Names," *California Historical Quarterly,* XXXII (1953): 43–48.

[2] For example, Hans Kretschmann, *Die -heim-Ortsnamen und ihre Bedeutung für Siedlungsgeschichte des Landes östlich der oberen und mittleren Weser,* Hamburg, 1938; Wilhelm Troll, "Die Bedeutung der Ortsnamen für die pflanzengeographische Forschung," *Zeitschrift für Ortsnamenforschung,* II (1926/27): 12–31; Leo Waibel, "Place Names as an Aid in the Reconstruction of the Original Vegetation of Cuba," *Geographical Review,* XXX (1943): 376–396.

with cultural features, especially certain suffixes of settlement names, such as -ton, -ham, -sted, and the like, the distribution of which has been so frequently used by English scholars to reconstruct past human movements in the British Isles.[3] Among the numerous generic terms used in place names of natural features in the United States, one of the most interesting is the word "bayou." It is proposed in this paper to show 1) the present distribution of the usage of the word as it is applied to the names of various kinds of water features in this country; 2) the present distribution of its usage as a folk-term; and 3) the origin and spread of the word, indicating its distribution at various time periods. It is hoped that such an investigation may reveal the value of the geographic treatment of generic terms as an aid to the study of imprints left on the cultural landscape by movements of ethnic groups.

THE PRESENT DISTRIBUTION OF "BAYOU"

The term "bayou" is ordinarily associated with sluggish channels and distributaries that occur within the lower Mississippi flood plain. Yet, Figure 1, which shows the present extent of the word as it is used in place names taken from modern topographic quadrangles and other large-scale maps, indicates a much wider distribution. From a focus in Louisiana, "bayou" encompasses most of the Gulf Coast. It extends northward up the Mississippi beyond Cairo, and is found occasionally along the lower Ohio and Wabash Rivers. A few bayous occur even on the upper Illinois and Maumee Rivers, and around Prairie du Chien, Wisconsin. Westward and northwestward from Louisiana, "bayou" place names continue into central Texas and up the Red, Ouachita, Arkansas, and White Rivers into Arkansas and Oklahoma.

Thus, "bayous" are not all confined to alluvial flood plains (Fig. 2). Although there is a close correlation of flood plain and bayou along the Mississippi and the Gulf Coast, the word exists also in the rolling uplands of northwestern Louisiana, eastern Texas, and northern Arkansas. Moreover, "bayou" is not restricted to names of full, sluggish streams, or distributaries. The distribution of four different modern connotations of the term appear in Figure 3.[4] Bayou as defined in the usual sense occurs mainly in the lower Mississippi delta area and in the alluvial coastal plain of eastern Texas. Northward within the wide Mississippi flood plain and along the Red River, bayous are chiefly intermittent, sluggish streams or flood channels, and, occasionally, ox-bow or other lakes. Similar features, sometimes called bayous, are found within the narrow flood plains of the Ohio, Wabash, and Illinois Rivers. Most of the bayous in east central Texas and those tributary to the Ouachita, Arkansas, and upper White Rivers, however, are mainly full-flowing

[3] See, for example, A. Mawer, *Problems of Place-Name Study*, Cambridge, 1929, especially Chapter 1, "Racial Settlement," pp. 1–40; Edward Taube, "Knock and Nickel: A Name Study," *Geographical Review*, XXXIV (1944): 428–435.

[4] *Webster's New International Dictionary of the English Language*, 2nd ed., 1939, gives six different usages of "bayou" as applied to water features. Four usages are defined in *Dictionary of American English*, I (1938): 167–168.

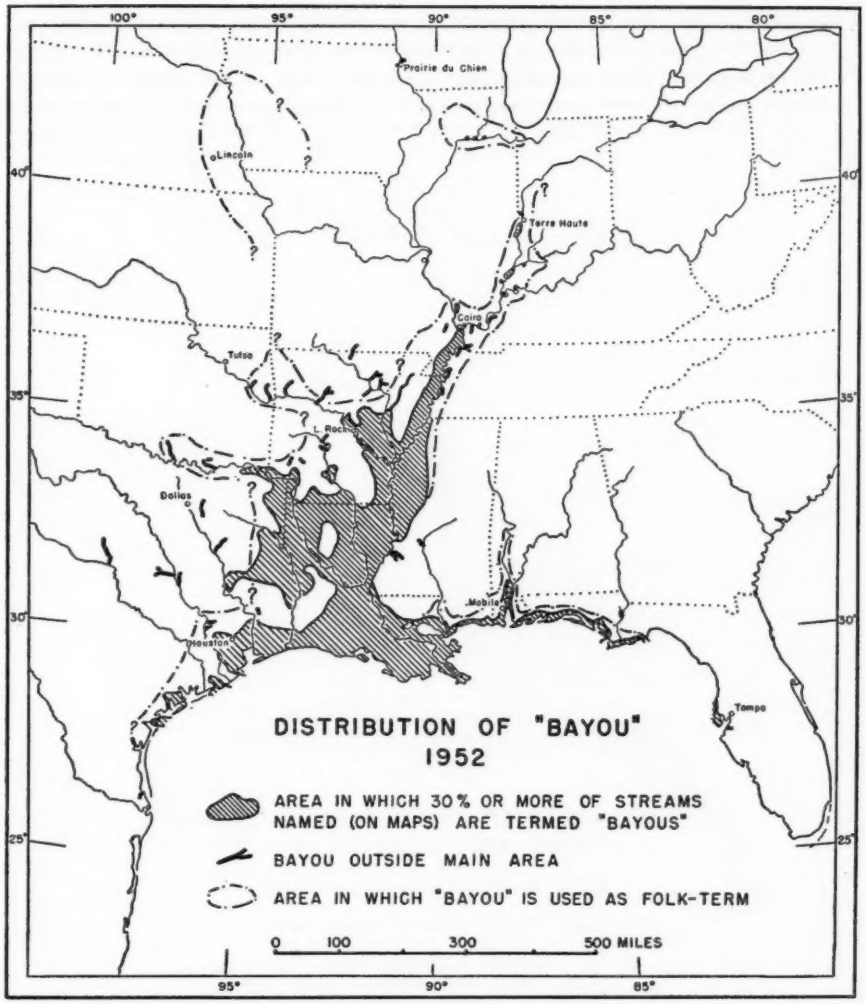

FIG. 1.

streams, clear and swift in their upper reaches, but usually turbid and sluggish near their confluence with larger rivers. Finally, along the Gulf Coast, the word "bayou" is applied to wide tidal inlets or bays and to tidal streams.

"BAYOU" AS A FOLK-TERM

It should be emphasized that the distribution of the term "bayou" as discussed above has been taken from place names shown on published maps. Maps, how-

ever, rarely indicate the true distribution of the generic parts of toponyms, particularly those of physical features, for such words are often employed as folk-terms, or are used in local place names in poorly mapped areas, or are applied to minor

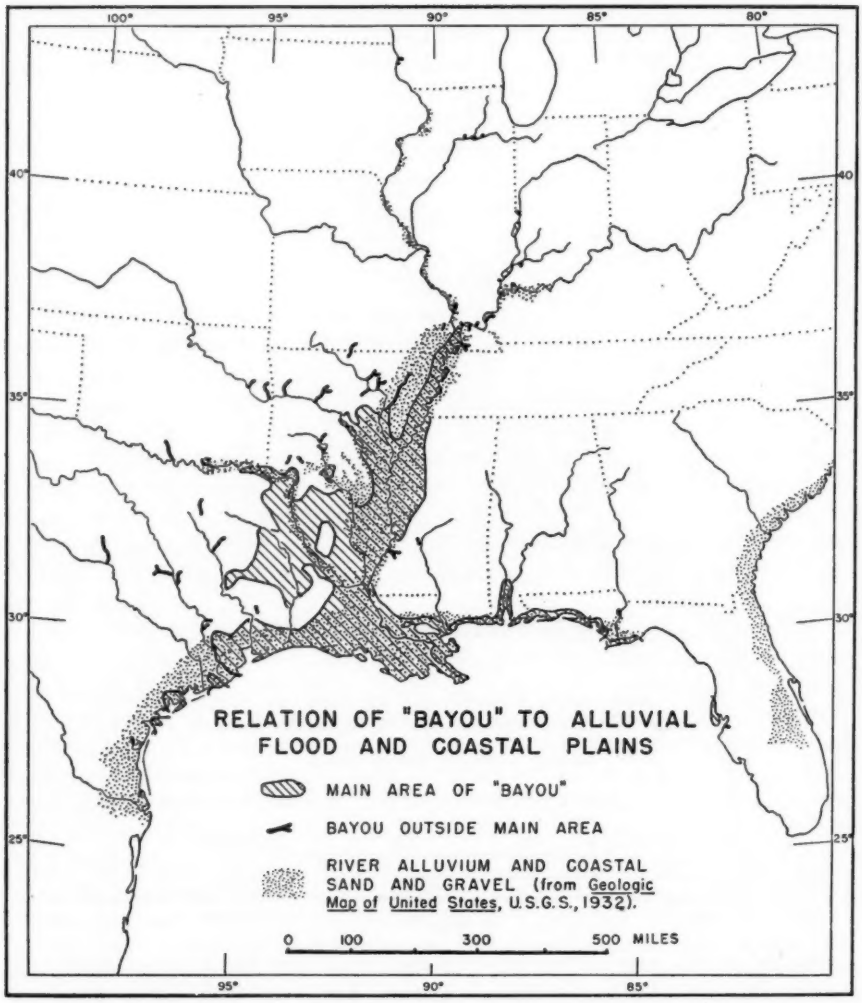

FIG. 2.

features that go unnamed on maps. On Figure 1 an attempt has been made to show the distribution of the local usage of "bayou." Although data are incomplete, it is seen that the word is employed in several areas outside those where the term is indicated on maps. For example, people in sections of eastern Kansas, eastern

Nebraska, and north central Illinois often use "bayou" to refer to small ox-bow lakes or channels along rivers, or to indicate low, wet spots in fields. Again, low, wet swales behind beach ridges along the southern shore of Lake Superior, north-

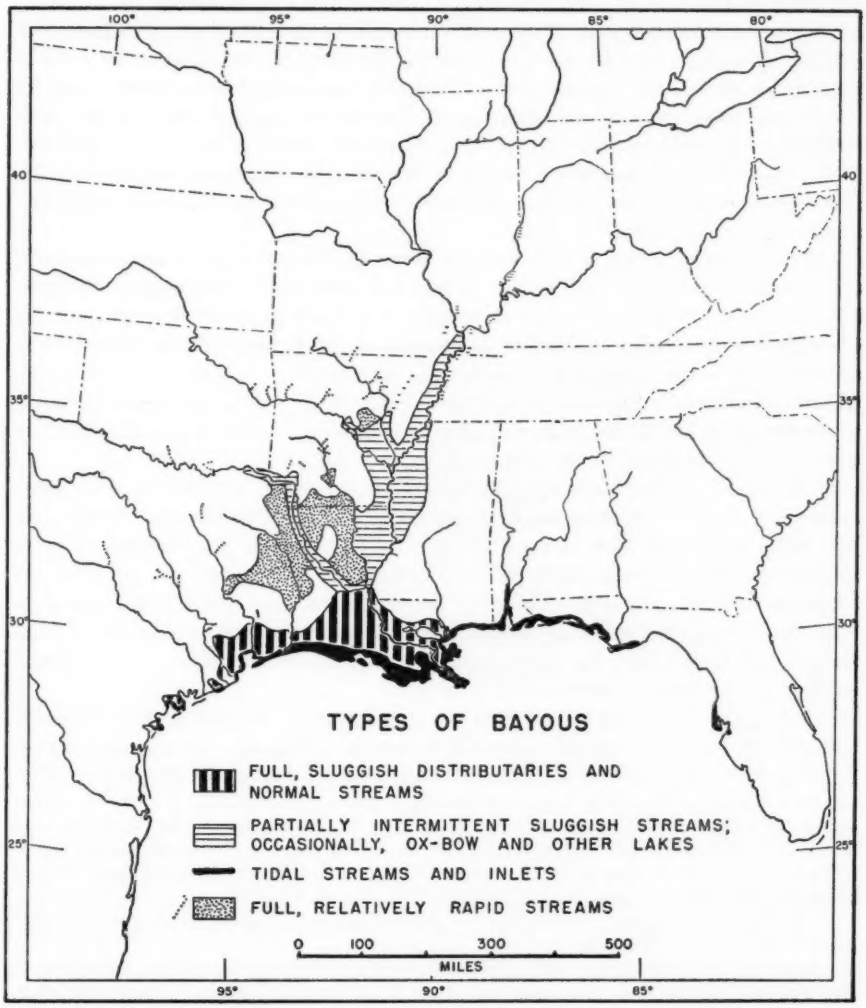

FIG. 3.

ern Michigan, are sometimes called "bayous" by local inhabitants.[5] The acquisition

[5] Most of the data on "bayou" as a folk-term were obtained by correspondence with persons living in, or acquainted with, the areas concerned. An occasional note on the use of the term in these areas was found in *American Speech*, e.g. IV (1914): 103; X (1935): 316; XIX (1944): 309.

of information on local usage of such terms is one of the most difficult aspects of place-name study, and requires extensive correspondence and field work.

ORIGIN AND SPREAD OF THE TERM "BAYOU"

The modern distribution of "bayou" immediately presents the problem of the origin and spread of the term. The facts that the word is characterized by a fairly continuous distribution and that it is replaced by Anglo-Saxon terms, such as slough and creek, near the periphery of its distribution, suggest that "bayou" was originally employed in place names by a particular ethnic group. The approach to the solution of this problem is obviously historical, and involves the study of the earliest maps and accounts of European settlement of the lower Mississippi area, the modern focus of "bayou."

The application of the term to streams in the Mississippi delta is associated with the earliest French settlement in that area at the close of the 17th century. Etymologically, however, "bayou" is not a French word, but is probably derived from the Choctaw *bayuk*, meaning a sluggish or stagnant water course.[6] Early 18th century accounts and maps apply the generic term *bayouc* or *bayouque* to the sluggish streams of the lower Mississippi and Gulf Coast areas. This fact gives credence to the supposition that the term was originally Indian. Later in the 18th century the word was shortened to its present form.

The term "bayouc" first appears in a French account of 1699, written by a member of a party exploring the northern shore of Lake Pontchartrain, which lies just north of present New Orleans[7] (Fig. 4). In the same year the first French settlement in the area was made near modern Biloxi, Mississippi, not far from the Mobilian Choctaw country. Probably these Indians gave the French the term "bayouc," for in their early exploration and trading expeditions in the lower Mississippi and Gulf Coast, the latter usually carried Mobilian guides, whose dialect had become the *lingua franca* in the delta area.[8]

During the remainder of the 18th century Louisiana French settlers, hunters, and traders spread the usage of the word "bayou" (Fig. 5). It was in the area

[6] The derivation of the word "bayou" from Choctaw *bayuk* was first suggested by A. S. Gatschet in 1884 (*A Migration Legend of the Creek Indians*, Philadelphia, p. 113). A similar origin was independently arrived at ten years later by W. S. Wyman ("The American word 'Bayou'," *The Nation*, XIX (1894) : 361). But the Indian origin of the word was not generally recognized until stressed by W. A. Read in 1927 (*Louisiana Place-Names of Indian Origin*, University Bulletin, Louisiana State University, XIX n.s., no. 2: xii).

[7] "Rélation de Pénicaut (1698–1699)," in Pierre Margry, *Mémoires et Documents Originaux*, Paris, 1887, V: 385, 387.

[8] *Ibid.*, pp. 425, 429 (1702), 442 (1704), 472 (1707). The word *bayuk* does not appear in *Byington's Dictionary of the Choctaw Language*, ed. by John R. Swanton and Henry S. Halbert, Washington, 1915. The word *bok* is given as the common Choctaw term for stream. It has been suggested that *bok* is merely a contraction of *bayuk*, but this change appears to be doubtful. The term *bok*, softened to "bogue," is still encountered in place names of streams in the old Choctaw country of central Mississippi and west central Alabama. *Bok* occurs unchanged as a generic term for some streams in southeastern Oklahoma, where the Choctaw were driven in the 1820's.

of permanent French settlement in the lower Mississippi and on the Gulf Coast from Lake Pontchartrain to beyond Mobile that the term became firmly established, especially after the founding of New Orleans in 1718. Moreover, French hunters and traders, going up the Red, Arkansas, and Ouachita to obtain buffalo hides and bear grease in the prairies of Arkansas and eastern Oklahoma for the New Orleans market, applied "bayou" apparently to the lower courses of tributaries of those rivers.[9] The term was even used as far west as the Rocky Mountains, where South

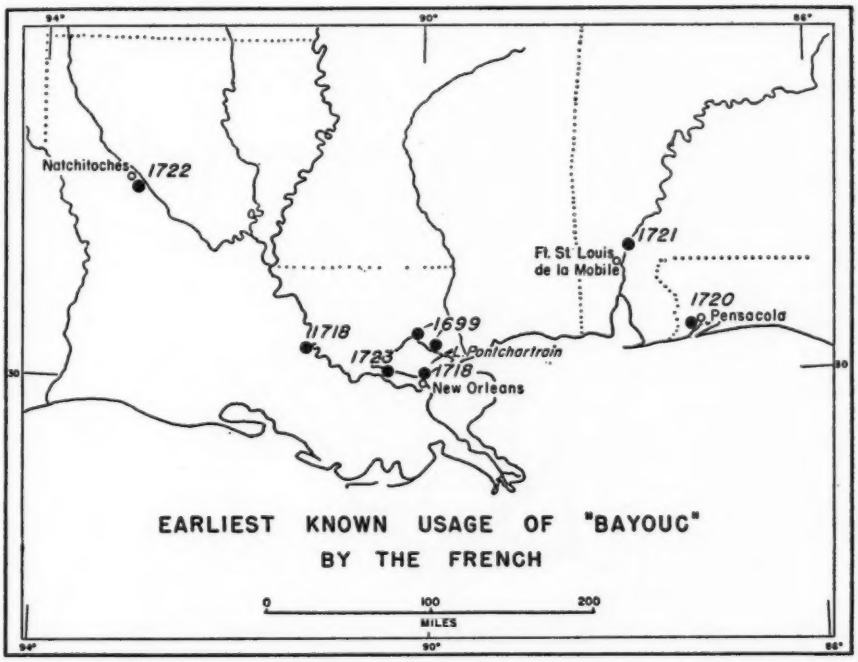

FIG. 4.

Park was once called Bayou Salade by the French hunters from the Arkansas.[10] On Figure 5, however, are indicated two areas in which during the 18th century "bayou" was used, but where the term is no longer current. One is the Alabama River, an ephemeral sphere of French activity in the first half of the century;[11]

[9] Among the numerous early maps showing the distribution of "bayouc" in the lower Mississippi area, the more significant are *Carte de la Louisiane*, 1732, by d'Anville and *Carte Reduite des Costes de la Louisiane et de la Floride*, 1764, by S. Bellin.

[10] Frederick Ruxton, *Life in the Far West* [1847], University of Oklahoma Press, 1951, pp. 11, 23, 32: H. M. Crittenden, *The History of the American Fur Trade of the Far West*, New York, 1902, II: 749–750.

[11] The *Carte de partie de la Louisianne . . .* 1733, by Baron de Crenay, uses the word "bayouc" for many small tributaries of the Alabama River.

the other area is along the Mississippi above the confluence of the Ohio, where the term was temporarily introduced probably by Louisianans who had migrated to the small French Canadian settlements in the lower Illinois country during the mid-18th century.

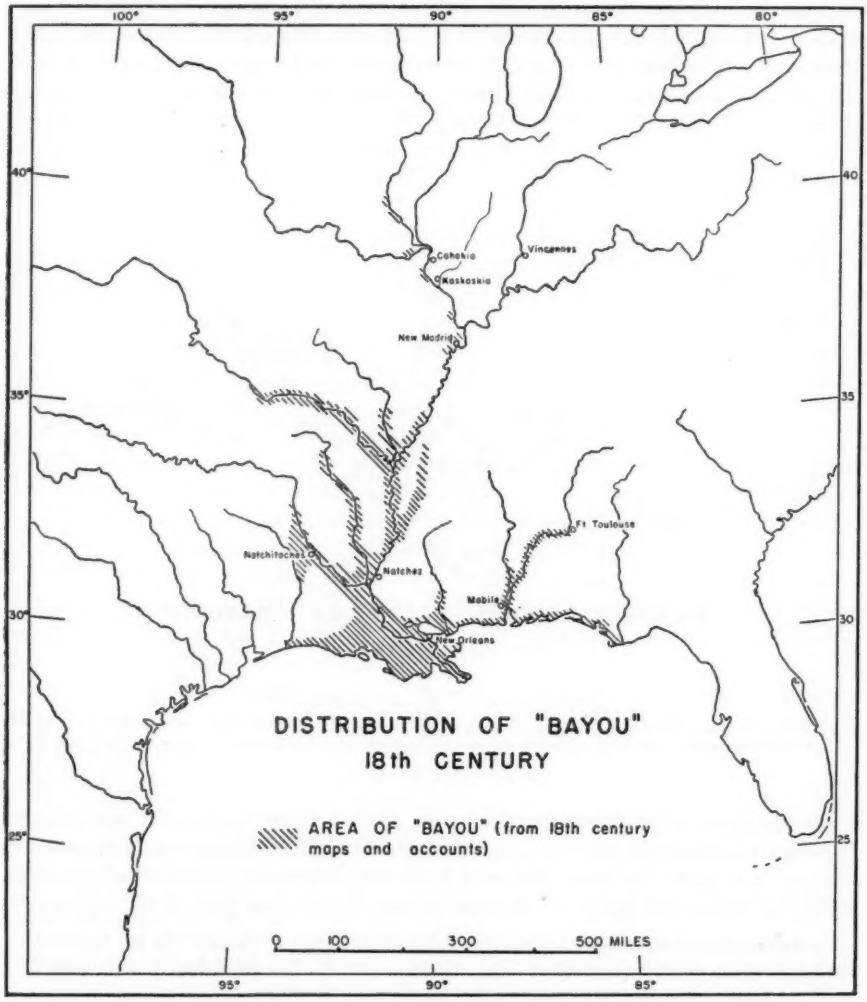

FIG. 5.

Figure 6, showing the distribution of "bayou" for the first half of the 19th century, depicts practically the modern extent of the term. The earliest map encoun-

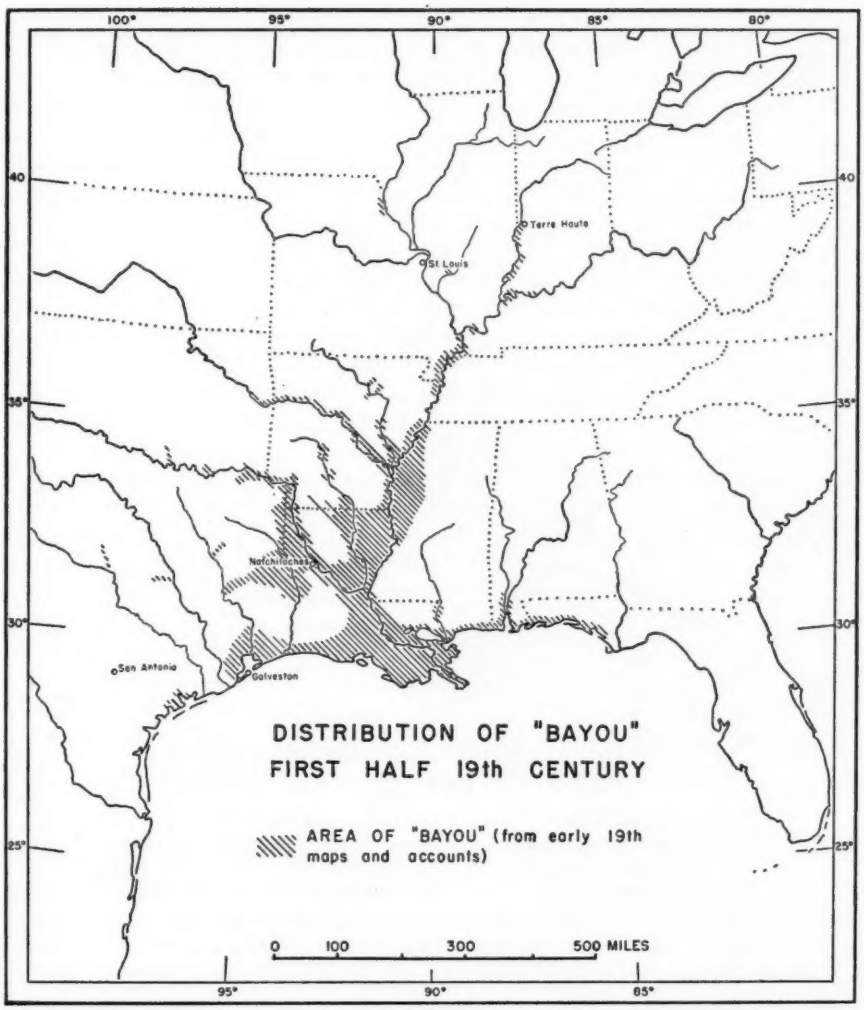

FIG. 6.

tered that indicates "bayous" on the lower Ohio and Wabash Rivers carries the date 1819.[12] Possibly, however, the term was first introduced into that area by

[12] H. S. Tanner, *The New American Atlas,* Philadelphia, 1819. An account of 1816 describing the Wabash, mentions frequently the term "bayou," meaning intermittent flood channels within the flood plain. ("Travels of David Thomas, summer of 1816," in *Indiana as seen by Early Travelers,* ed. by Harlow Lindley, *Indiana Historical Collections,* II: 42–135, ref. on p. 87).

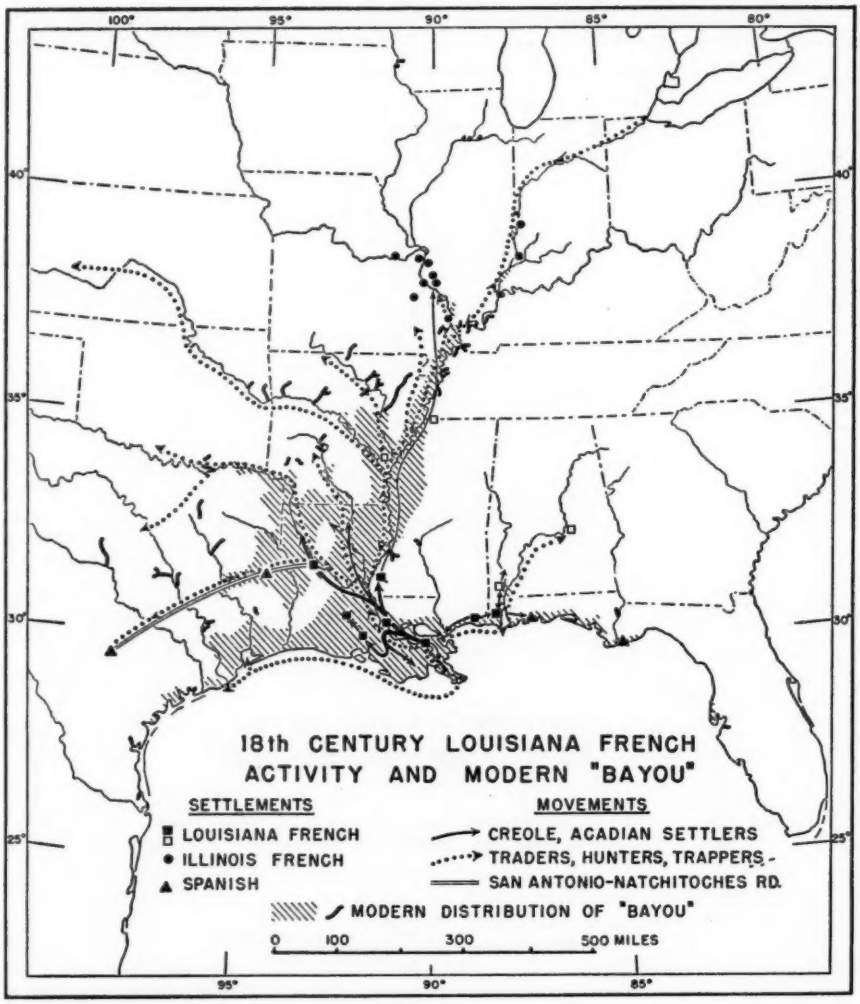

FIG. 7.

Louisiana French engaged in trade with Canada; for it is well known that during the 18th century the Wabash formed the most important route between the Great Lakes and the Mississippi. Even after the beginning of the 19th century, Louisiana French crews continued to man river boats on the Mississippi and its tributaries.[13]

[13] For a detailed account of Louisiana French trade during the 18th century, see N. M. Surrey, *The Commerce of Louisiana during the French Regime, 1699–1763,* New York, 1916.

As in the case of the Wabash, maps and accounts do not indicate the spread of "bayou" into east central Texas until the early 19th century.[14] Again, it is likely that the term was applied to streams in that area at an earlier date, for the coincidence of the distribution of "bayou" with the Natchitoches-San Antonio trail strongly suggests that the word was introduced into eastern Texas from Louisiana through the medium of 18th century French-Spanish trade over that road. The occasional bayous that occur today in the center of Texas are difficult to explain, but it is known that French trading parties from Louisiana regularly entered that area in the mid-18th century to trade with Indians.[15] Again, the bayous of the east Texas coast may have been named first by French traders from New Orleans, who by the 1740's were anchoring their boats off the mouths of the Neches, Trinity, and Brazos Rivers to obtain skins and horses from the Attakapa Indians.[16] During the early part of the next century the presence of Louisiana pirates along the coast and subsequent French settlement from Louisiana, probably entrenched the term "bayou" in the Texas gulf area (Fig. 7).

The occurrence of "bayou" as a folk-term in areas outside those where the word is indicated on maps appears to be relatively recent. During the past 25 years, for example, people from Arkansas and southeastern Oklahoma, where "bayou" is currently used, have migrated into eastern Kansas and Nebraska. These migrants may have been instrumental in expanding the local usage of the term. Moreover, it has been suggested that the usage of "bayou" in north central Illinois might have been introduced after the Civil War by northern veterans of the Vicksburg campaign, which took place in bayou country.[17]

In some areas, however, where "bayou" appears on maps as the generic part of a formally recognized place name, the word may no longer be used as a folk-term. Parts of eastern Texas, northern Arkansas, and even sections of northeastern Louisiana are examples of such loss in folk usage.

CONCLUSION

Since its usage in place names was spread chiefly by Louisiana French, the present distribution of "bayou" might possibly be employed as a partial index to the areal spread of the cultural influence of a given ethnic group during the 18th century. The outer margins of the present distribution of the term, however, appear to be contracting, especially in the north and west, where people of Anglo-Saxon origin have largely replaced the Louisiana French word with their own

[14] Tanner's *Atlas* (1819) shows many bayous along the central part of the Sabine, and a few along the central part of the Neches. *J. de Córdova's Map of the State of Texas . . .*, compiled by Robert Creuzbaur, Houston, 1849, shows approximately the modern distribution of bayou in Texas.

[15] Herbert E. Bolton (ed.), *Athanase de Mézières and the Louisiana-Texas Frontier, 1768–1780*, I: 47–48, Cleveland, 1914.

[16] *Ibid.*, p. 53. The earliest map encountered that shows bayous along the Texas coast is that of Stephen Austin, *Mapa geográfico de la Provincia de Texas*, 1822.

[17] Professor John H. Garland, personal communication.

terms, such as slough, creek, lake, or pond. But within the core of its present distribution, in Louisiana, southern Arkansas, and southeastern Texas, the term appears to be firmly entrenched, in spite of the incursion of people of varied cultural backgrounds in the last 100 years. Studies of other generic terms in place names of physical features in the United States might uncover significant leads in tracing cultural diffusion.[18]

[18] After this article had gone to press the writer was informed that the term "bayou" is used along the lower courses of the Kalamazoo, Grand, and Manistee Rivers in western Michigan. There it is applied chiefly to drowned river mouths of short streams tributary to the lower portions of those rivers. Unfortunately, it was not possible to indicate these bayou areas on the maps. Apparently, the use of the term in western Michigan is old, for "bayou" appears on maps of that area published in the early 19th century. (See, for example, *An Improved Edition of the Map of the Territory of Michigan, 1835,* compiled and edited by John Farmer.)

Accepted April 1953.

THE BASIS AND SIGNIFICANCE OF VITICULTURE IN SOUTHWEST FRANCE*

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THE agricultural southwest of France has justly earned its reputation as the country's most important production center of quality wines and wine brandies. It has achieved this status by an evolution through many centuries in an area where the physical environment has not been a handicap, but where the influence of man has been decisive in the eventual success of viticulture and its economic consequence to the region and to France. The association of wine with the area goes back to ancient times, while brandy entered into the regional economy as recently as the seventeenth century.

Records indicate that viticulture under the Romans was highly developed, but that during the series of invasions and occupations which coincided with and followed the fall of the Roman Empire large expanses of vineyards were destroyed. A close and lasting commercial tie between the port of Bordeaux and viticulture was initiated in the twelfth century when the English began their three hundred year rule over southwest France.[1] On the one hand wine was in great demand in England and countries to the north; on the other, the Roman Catholic Church, and especially the monasteries, had created anew centers of viticulture which could serve as the nuclei for an expansion of wine production. Moreover, there were the ports along the coast and on the lower courses of rivers, such as Bordeaux, La Rochelle, and Bayonne, providing easy access from the sea. The combination of these factors provided the basis for the growth of vineyards in the vicinity of these ports, and soon Bordeaux and La Rochelle became great rivals.[2] Bordeaux, however, remained the largest and most permanent production and export center of wine on the Atlantic coast.

In centuries to follow, the commerce of wine and with it the economic well-being of the winegrowing areas of southwest France passed through many cycles of crisis and prosperity as a result of wars, other political disturbances, changes in economic and social structure, and also of natural disasters which affected crop yields. Prosperous periods brought great demand for wine, and new lands were planted in vineyards, with the consequence that during depressions there was chronic overproduction, a problem which has recurred to this day.

A map showing the distribution of vineyards in southwest France in 1952 (Fig. 1) indicates clearly one major concentration and several minor ones of land

* This article was written under the joint auspices of Rutgers University and the Office of Naval Research.

[1] In 1152 Eleanor, Duchess of Aquitaine, married Henry Plantagenet, who shortly afterwards became Henry II of England. The Aquitaine, which corresponds roughly to southwest France as considered here, then passed to English rule under which it remained until 1453.

[2] Roger Dion, *La Création du Vignoble Bordelais.* Angers: Editions de l'Ouest, 1952. p. 47.

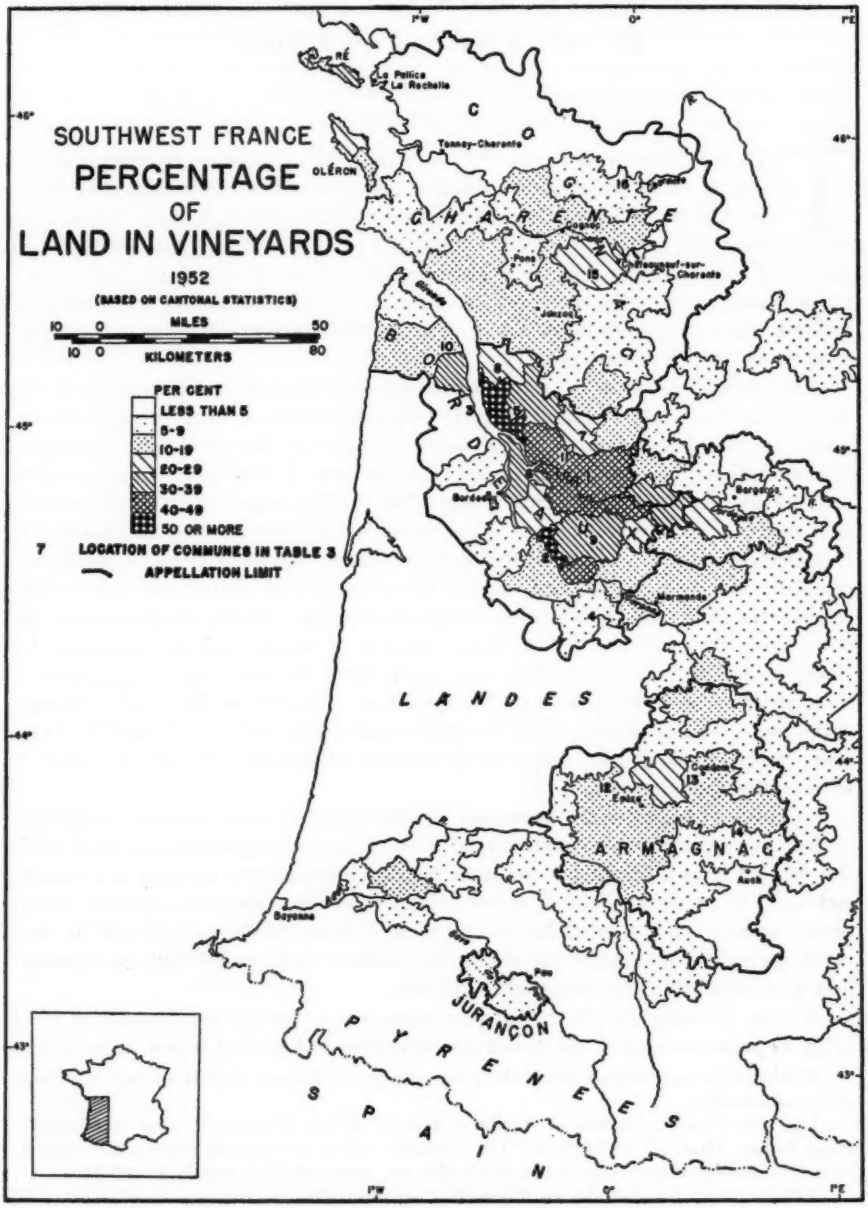
SOUTHWEST FRANCE
PERCENTAGE
OF
LAND IN VINEYARDS
1952
(BASED ON CANTONAL STATISTICS)
MILES
KILOMETERS
PER CENT
LESS THAN 5
5-9
10-19
20-29
30-39
40-49
50 OR MORE
LOCATION OF COMMUNES IN TABLE 3
APPELLATION LIMIT
LANDES
ARMAGNAC
PYRENEES
SPAIN
JURANÇON

FIG. 1.

in vineyards. Foremost is the region drained by the lower Garonne and Dordogne Rivers and their tributaries, together with the slopes along both sides of the Gironde Estuary. Vineyards form a continuous zone there to beyond Bergerac on the Dordogne and beyond Marmande on the Garonne. Nevertheless, the region has been divided for the purpose of wine classification into two areas of *appellation contrôlée*. In one, wines are authorized to carry the label "Bordeaux" or any of its constituent parts, and in the other they carry brand names originating in the Arrondissement Bergerac of the Department Dordogne. This separation came about despite strong objections from the winegrowers of the Dordogne,[3] but there was a historical precedent for it arising out of the period of English rule.

At that time the inhabitants of Bordeaux obtained from the king the privilege of bringing into the city duty free the wines originating on their estates located within the limits of a certain area around Bordeaux, which came to be designated the *sénéchaussée privilégiée*.[4] Wines produced outside this limit—and Bergerac was outside—were not only subjected to special taxes, but also could not be brought into the city before late fall or early winter. In this way the Bordeaux proprietors were given a monopoly which was perpetuated through centuries until the French Revolution. With the abolition of the old provinces of France and their administrative subdivisions and with the creation of the new departments in 1790, the privileges were also eliminated and the wine trade began to operate freely. When, in the present century, areas of appellation were designated by law, the winegrowers of the Department Gironde claimed again, and obtained the exclusive title to, the label "Bordeaux," while Bergerac was compelled once more to use different names for its wines.

Other vineyard concentrations on the map are less dense, but not necessarily of lesser importance. To the north of the Department Gironde is a region known as the Charente, which encompasses most of the Departments of Charente and Charente Maritime, including the islands of Oléron and Ré. Here as in other interior areas the Dutch in the seventeenth century wielded great influence in the development of viticulture.[5] They stimulated the extension of vineyards producing white wine and also encouraged its distillation. The winegrowers then turned more and more to distillation when a serious crisis in the wine market developed, and began to specialize in the manufacture of wine brandy, or Cognac (after the town of Cognac), as the beverage became to be known toward the end of the eighteenth century. This region was also delimited ultimately as a zone of appellation, and the name Cognac can be given legally only to wine brandies produced within its limits.

South and southeast of the Department Gironde is a concentration of vineyards

[3] Albert Balet, *La Délimitation des "Vins de Bordeaux" devant le Conseil d'État.* Agen: Imprimerie Moderne, 1911.

[4] Henri Kehrig, *Le Privilège des Vins à Bordeaux jusqu'en 1789.* Paris: G. Masson, 1886. p. 1.

[5] Henri Enjalbert, "Comment naissent les grands crus: Bordeaux, Porto, Cognac," *Annales —Economies, Sociétés, Civilisations,* VIII, No. 3 (July–Sept. 1953): 324–325.

around the cities of Condom and Eauze. Like the Charente this was a wine producing area in the Middle Ages. Probably in the late sixteenth century winegrowers turned to the distillation and manufacture of brandy.[6] About 1860 the brandy became associated with the name Armagnac, a name derived from the old county of Armagnac which existed in the tenth century. This brandy has also been protected by the appellation laws.

One outlying concentration remains in the southern Aquitaine Basin. This small center of viticulture is named after the town of Jurançon on the banks of the Gave de Pau opposite the city of Pau. Total production is small, and the bulk of what is produced is sold as ordinary table wine rather than under its brand name.

In other parts of southwestern France not yet mentioned nearly every canton has some land in vineyards, the wines from which are generally consumed on the farms and therefore have little or no economic significance for the region as a whole. Nowhere in this part of France is the production of table grapes emphasized. Grapes consumed within the area are brought in from a specialized region further upstream along the Garonne River, or, at times, from Spain.

The present pattern of distribution of viticultural districts in southwest France thus is an expression of man's activities in the past. Concern for environmental factors had been expressed only in those years when late frost, heavy rains or hail, lack of precipitation, or disease decimated the year's crop and therefore the year's earning. Only in the course of the last hundred and fifty or two hundred years, when scientific improvement of wine quality has meant survival, has attention been turned to the relationship of enivronment to viticulture.

THE QUESTION OF ENVIRONMENTAL FACTORS

Among environmental factors there are three which affect favorably or adversely the quality of wine and brandy, namely climate, soil, and variety of vine grown. Together these form a physical complex which must be studied in its entirety and in conjunction with human factors involved in the wine and brandy production. No one factor alone can be said to attribute exclusive influence in the quality production of certain areas, although climate has been singled out by some writers.[7] Grapes are grown successfully within a wide range of latitude and under greatly differing climatic conditions. Yet, it has been maintained by these writers that the Mediterranean climate is the natural and best habitat of the vine; and by still others that the vines grow so profusely in that climate that the quality of the grapes is impaired in comparison to those grown in the more severe climates of the temperate middle latitudes.

If the climatological data for the observatory at Bordeaux-Floirac are examined

[6] "L'agriculture dans le Department du Gers," *Annales de l'Office Agricole Régionale du Sud-ouest,* No. 18 (1931): 57.

[7] Roger Dion cites several references in "Grands traits d'une géographie vinicole de la France," *Révue d'Histoire de la Philosophie et d'Histoire Générale de la Civilisation,* XII (January–March 1944).

(Table I), the figures for annual average temperature and precipitation are what one would expect near and on the west coast of Europe. The average winter temperatures do not even approach the freezing point while the summer averages barely reach the hot register. Precipitation is not ample, but is distributed throughout the year with a slight decline during the two hottest months. A perusal of annual records, however, shows that the total annual as well as the monthly amount of precipitation is extremely variable. While over the long range November is the rainiest month, it is October in some years and May in others; in one year the annual total was 22 inches, and it has been as much as 36 inches in another year. Late in Spring, normally, high temperatures and high precipitation coincide, causing a rapid growth of branches and leaves on the vines and representing a critical period from the standpoint of disease. The average number of days with rain and the average per cent of sunshine data indicate that the minimum number of days

TABLE I*

BORDEAUX
AVERAGE ANNUAL TEMPERATURE, PRECIPITATION AND INSOLATION
1880–1949

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Annual Average Temperature (°F.)	41	44	48	53	59	65	68	68	64	56	48	42	55
Annual Average Precipitation (in.)	2.5	2.2	2.5	2.5	2.7	2.5	1.9	2.0	2.5	3.2	3.3	3.2	31.0
Average No. of Days with Rain	19.5	16.2	17.7	17.9	16.8	14.8	13.2	12.8	14.3	18.9	20.7	22.3	17.1
Per Cent of Sunshine	26	31	41	45	44	51	55	52	46	39	27	24	40

* Source: Data for temperature and precipitation are from the records of the Observatoire de l'Université de Bordeaux; those for insolation, from the records of the Centre de Recherches Agronomiques du Sud-ouest and cover the period 1924–1952.

with rain and, conversely, the maximum period of insolation fall in the summer months when most needed for the ripening of grapes. Climatic data for an equivalent period are not available for other parts of the region. Official statistics[8] do indicate nevertheless that temperature and precipitation regimes are very similar to the Bordeaux area in both Charente and Armagnac.

The climate in the southwest of France is neither as severe as that of viticulture areas further north and in the interior of the continent, nor is it as mild as along the borders of the Mediterranean Sea. Furthermore, except for valley floors at higher elevations, the sites of fields do not indicate any special consideration to microclimatic conditions, although such conditions do effect variations in the quality of grapes from year to year. For example, vineyards can be found in the floodplain of the Garonne and Dordogne Rivers despite the fact that from the microclimatic standpoint this location may be hazardous in some years. Vineyards have been

[8] Obtained from the Service Météorologique de Métropole et d'Afrique de Nord in Paris.

planted on slopes facing south as well as north; the advantage of one slope as against the other depends on the weather during each year. A prolonged period of hot and dry weather may damage the quality of grapes on the sunny side, while a relatively cooler growing season retards the growth on the northward facing slopes.

Thus the vintages are affected by the various climatic years. For instance, the years 1927, 1930, and 1951 had too much rainfall, too little sunshine, and simultaneous occurrence of fog in the most critical period of maturing of the grapes, between August 10 and September 10. The quality of the wine produced in those years was considered bad, because not enough sugar formed in the grapes and because high humidity favored the incidence of disease, especially mildew. Moreover, the frequent rains made application of chemicals next to impossible. On the other hand, there had been many more years in which excellent vintages have been produced. 1937, many years in the forties, and 1952 were all years when the two critical months were hot and sunny, favoring the accumulation of sugar, and when brief intermittent rainfalls provided necessary moisture to the ground. Thus, despite occasional hazards, the climate of the region as well as of specific localities within the commercial areas of southwest France cannot be considered a handicap to viticulture.

A physical factor of great importance in variety and quality of wine is soil. The physical and chemical composition, the ability of the soil to heat up and to retain moisture, and the facility for adequate drainage all influence the type of wine produced in the vineyards. G. Lafforgue, a viticulture expert in the Gironde, has determined for example that iron in the soil will deepen the color of red wines; lime will increase the alcoholic content and will preserve the quality of wine for a longer time; these and other chemical elements will greatly affect the body of the wine and its taste.[9]

Physiographically the areas of commercial viticulture in southwest France are all within the Aquitaine Basin, the surface of which is covered largely by sedimentary materials brought down from the Massif Central and the Pyrenees. Within any given section, therefore, a wide range of immature soils can be found, originating from old or recent alluvial deposits and creating great differences in the types and qualities of wines produced for consumption and distillation. Certain meaningful and significant generalizations concerning their distribution can be made, however.

From the standpont of quality wine production three principal areas are recognized. For two of these, sands and gravels provide the chief soil elements. In the Bordeaux wine region there is a band of gravelly soils of varying width which extends along the left bank of the Garonne-Gironde, except for the northernmost portion near the mouth of the estuary. These are the soils of the famous Bordeaux wine districts which include the appellations Médoc, Graves, and Sauternes (Fig. 2).[10] The gravels are very coarse in the Médoc (Fig. 3) and are underlain by

[9] G. Lafforgue, *Le Vignoble Girondin*. Paris: Louis Larmat, 1947. p. 52.

[10] Not all appellations are shown on this map. For complete details the reader is referred to L. Larmat, *Atlas de la France Vinicole*, "Les Vins de Bordeaux," Paris.

clay and coarse sand, the latter being more favorable to subterranean drainage. Toward the south and in the Graves and Sauternes the gravels become progressively smaller as elevation increases and the surface becomes more dissected.

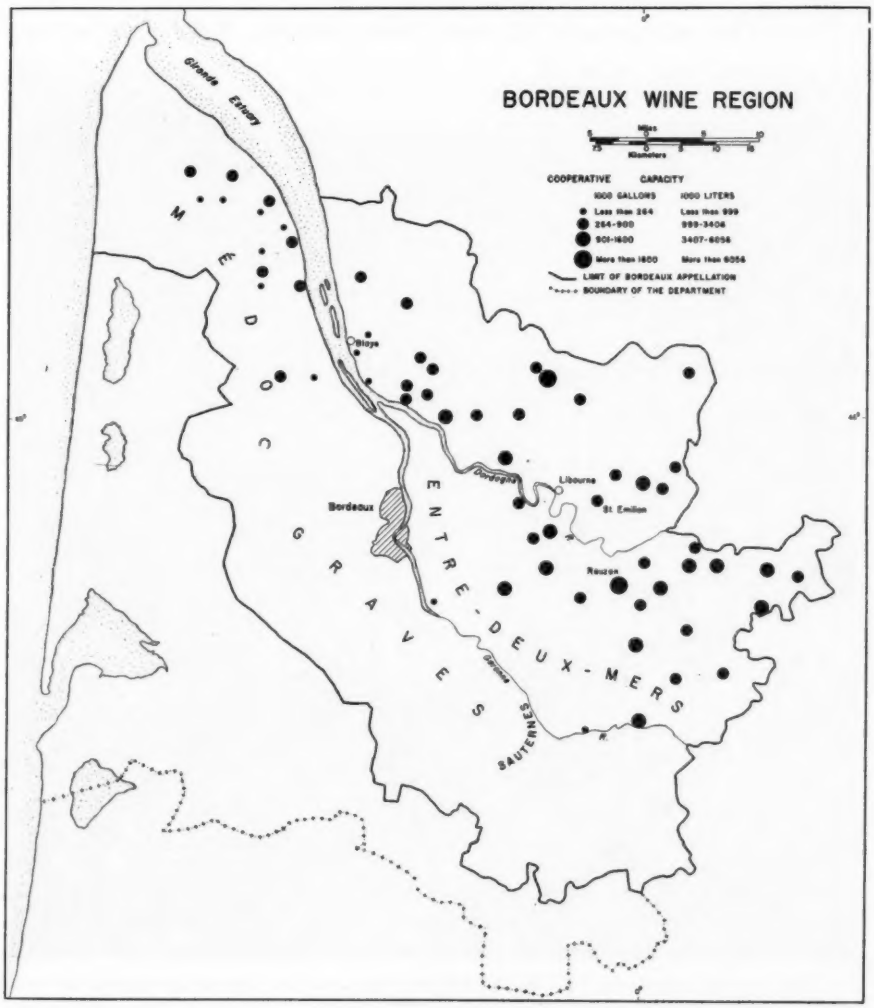

FIG. 2.

There is a greater admixture of other components, especially clay and iron compounds, which have been deposited by ground water at lower levels. Where erosion has cut into the limestone bedrock, the gravels are absent on the slopes, and the

topsoil is calcareous and clayey. In northwestern Armagnac, the second major area, the soils are sandy and clayey sands with clayey and siliceous ironized subsoil.[11] This is the lowest part of the area. Surface as well as soils blends into the Landes pine forest to the west and northwest.

In the Charente, calcareous soils formed from underlying chalky limestone pro-

FIG. 3. Coarse, gravelly soils in the Médoc. Vines are old and not yet pruned for new spring growth. Photo Weigend.

vide the heart of the vineyard country. The Champagne, as it is known, can be outlined roughly by a line connecting the cities of Cognac, Pons, Jonzac, and Châ-

[11] Pierre de Vignau, "L'Armagnac," *La Revue Vinicole,* I, No. 10 (April 1951): 68.

teauneuf-sur-Charente (Fig. 1). This most fertile part of the Charente is the area to which the city of Cognac owes its success and fortune.[12]

The three soil areas represent a wide range of natural fertility. In the case of wine it is maintained that the best quality wines are produced from meager and gravelly soils. The high quality of certain Bordeaux wines is attributed to the fact that the varieties of vines grown will produce high quality grapes for wine on gravels where hardly any other crop will succeed. There is no concerted effort to improve the soil by the use of commercial fertilizer. Proprietors do apply manure sparingly, but some only at twenty year intervals.[13] In the production of wine brandy no such close link between soil fertility and brandy quality exists. Thus to increase the yield per acre of grapes for distillation commercial and natural fertilizers are used freely.

On soils elsewhere production of wine and brandy is generally of lower quality. Between the Dordogne and Garonne Rivers is an area known as Entre-Deux-Mers, which is covered by soils composed of a mixture of sands and clays in varying proportions. Because of a downwarp along the left bank of the Garonne River the surface is at least 160 feet above the gravels of the opposite bank of the Garonne, giving it the appearance of a large platform which has been deeply dissected by numerous streams flowing northward to the Dordogne and southward to the Garonne. Where limestone bedrock has been exposed the soils are calcareous. The most extensive exposures of limestone have occurred in the major valleys themselves, on the high and steep right valley sides of the Garonne-Gironde and the Dordogne. There the soils are marly and limey, mixed with clays, and produce wines of their own distinction and appellation such as St. Émilion and Blaye. These soils are more fertile than the gravels and the volume of production is consequently greater.

North of the Dordogne and Gironde and beyond the calcareous slopes, a belt of sandy-clayey soils recurs. Gradually toward the north and west these soils become sandier, vineyards scarcer, and forests more predominant. This sandy zone is known in the Charente as the Bois and extends generally as far as the Charente River encircling the Champagne. The soil is acid, but suitable for the production of that type of white wine needed for distillation. North of the Charente River the sands are largely absent and residual calcareous clay soils cover the limestone bedrock. Although this was one of the earliest viticultural areas of France, few vineyards have remained since the general destruction caused by the phylloxera in the late nineteenth century.

Two small sections of the Charente are different in appearance and soil cover. North of Cognac is a depression with heavy and humid clayey soils where vineyards prospered even during the phylloxera crisis. Northwest of the city is an area at the same elevation as the Bois, but more dissected, which is covered with somewhat

[12] Louis Papy and Henri Enjalbert et al., *Visages de l'Aunis de la Saintonge et de l'Angoumois,* Collection "Provinciales." Paris: Horizons de France, 1952. p. 14.

[13] General Manager of the Château Lafite-Rothschild in the Médoc.

lighter pebbly and sandy clayey soils. These soils transmit characteristics to the brandy which are distinctive and serve well in the final blending.

In Armagnac elevation increases somewhat and the low rounded slopes become hills as one leaves the heart of the production area toward the east and southeast. The topsoil becomes increasingly clayey and calcareous,[14] and the iron content in the subsoil diminishes. Conditions are unfavorable for the varieties of vines which are grown in this general region; vineyards are less frequent and scattered (Fig. 1) and much of the production is for ordinary table wine marketed locally.

The remaining soil group is the recent alluvium of floodplains and natural levees, a group which is most widespread in the valleys of the large rivers, the Dordogne and the Garonne-Gironde. There the natural levees, or *palus,* bordering the stream beds are of special importance because their vines produce abundantly. However, the quality of the wine is not sufficiently high for classification, and the entire output is sold as ordinary table wine.

Still another factor of importance to quality production is the selection of vine varieties according to what is to be produced in the end—type and quality of wine or brandy—in a given area. Suffice it to say here that certain varieties are prescribed by the appellation laws for specific zones.[15] In practice it has been found that a variety which grows well in one location and produces a wine or brandy with certain characteristics may yield wine or brandy with entirely different characteristics elsewhere. Man has therefore chosen which varieties of plants to use in combination with other environmental factors, in order to achieve what he wants. Even after a careful choice of physical requisites has been made, the major part of man's influence on the quality of the wine or brandy he produces becomes evident only by way of the care he gives to the vineyard, the maufacture of the wine or brandy, and its storage.

THE INFLUENCE OF HUMAN FACTORS IN PRODUCTION

Until the end of the seventeenth century wines were of mediocre or poor quality, even though they were grown under environmntal conditions similar to those today. It was then that a serious crisis in the wine trade developed because of excessive taxation, expansion of competitive domestic and foreign vineyards,[16] and losses of markets. Furthermore, competition began to be felt with new beverages such as beer and various types of hard liquor. In the Charente and Armagnac the commercial winegrowers attempted to solve the problem by turning to the manufacture of brandy, while in the regions of Bordeaux and Bergerac a revolution in the winegrowing and winemaking processes started and slowly progressed in the endeavor

[14] Z. Baqué, "Les eaux de vie d'Armagnac," *Revue Géographique des Pyrénées et du Sud-ouest,* I, No. 3 (July 15, 1930): 352.

[15] For greater detail the reader is referred to: Charles Quittanson, Adrien Ciais, René Vanhoutte, *La Protection des Appellations d'Origine des Vins et Eaux de Vie et la Commerce des Vins.* Montpellier: La Journée Vinicole, 1949.

[16] Louis Papy. *La Côte Atlantique de la Loire à la Gironde,* Volume II, "L'homme de la mer." Bordeaux: Delmas, 1941. p. 115.

to achieve a high quality product. As success in this struggle became recognized, the growers and merchants were faced with yet another problem, namely the imitation of names of their quality products in other parts of France and the world. Even locally a number of merchants took advantage of the situation and began to sell low grade wines under good labels. In an attempt to counteract this and at the same time to maintain quality, beginning in 1909 France passed a series of appellation laws referred to earlier. Regions were delimited within which grapes for brand name wines and brandies could be grown and produced only in compliance with specific regulations.

With respect to wine these regulations require that the type of soil be approved by agricultural agents for example, marshlands and natural levees are excluded everywhere. Moreover, as already noted, only designated varieties of vines can be planted within each appellation area, and the vines must be pruned according to specification. Also, the yield per acre is strictly limited. In the Sauternes area, for instance, the annual yield per acre must not exceed an average of 267 gallons over a five year period, while in Entre-Deux-Mers and wherever the appellation is merely "Bordeaux" without any other identification, the limit of annual yield per acre averages 535 gallons. Hence land producing highest quality wines is most strictly limited in production per acre. Finally, the must, i.e., the unfermented liquid before it is wine, has to contain a minimum amount of natural sugar, and the wine after fermentation a required minimum alcoholic strength. As with the other criteria, these vary with each appellation. If wines are not produced according to all these regulations, they may not be called "Bordeaux," or by any of the regional appellations like St. Émilion, and must be sold as ordinary table wines.

Rules for the production of wine brandies differ in several respects. No specific approval of land within the delimited areas is necessary; the pruning is done according to local custom; and there is no limit as to yield per acre or of sugar and alcohol content of must and wine. However, the varieties of vines grown are prescribed and distillation of the wine is strictly controlled in method and equipment.

These controls have not been entirely successful in their ultimate purpose. Some countries do not protect French appellations even though they may be signatory to an international agreement to honor them. Above all, there are the variations in the ability and desire of winegrowers to take proper care of the vineyards, harvest the grapes at precisely the right time, and produce good wine or brandy within the framework of law provided for their protection.

The law permits much leeway, so that care in production is an individual matter. The special harvesting of grapes for the sweet Sauternes wines is a case in point, because the grapes must be picked individually when they have reached a certain degree of rot (*pourriture noble*) (Fig. 4) which is necessary for the concentration of sugar. A premature or late harvest depreciates the quality of the wine. Furthermore, not all proprietors, cooperatives, or other wine poducers have machines and tools made from the same materials. For instance, at the Château Mouton-Rothschild nothing except wood may be used in any part of the winemaking process

FIG. 4. Grapes grown in the Sauternes, illustrating varying degrees of rot. Photo C. I. V. B.

from the vine to the bottle, and every year the "new wine" ages in new oak barrels. During this process some of the tannin is absorbed by the liquid and the quality is improved. There are other wine producers who do not hesitate to use metal implements and cement-lined fermentation vats. Between these two extremes are a great many variations, based on custom, preference, and expediency.

For brandies, one of the most crucial points in the production process is the distillation and the attention given at that time. Armagnac has only one distillation, while Cognac has two successive ones. In either process constant surveillance is required, because even a slight change in temperature in the kettles may affect the quality of the brandy. After distillation, quality depends largely on proper care during aging, filtering, and blending, and there too custom and individual preference create variations.

If the human factor is of such consequence, it should follow that organization and financial resources of the winegrower are closely related to the quality of the product. For wine production this certainly holds true. Table II shows the dis-

TABLE II*

DEPARTMENT GIRONDE
VINEYARD PROPERTY AND WINE PRODUCTION
1924

Area of Vineyard Property (acres)	No. of Holdings	Surface			Production		
		Avg. (acres)	Total (acres)	% surface in vineyards	Avg. per acre (gals.)	Total (gals.)	% of Dept.
Less than 7.4	50,301	2.8	140,400	42	246	33,942,005	29
7.4–24.7	8,909	12.5	111,088	33	481	52,680,583	44
24.7–74.1	1,096	39.5	43,314	13	428	18,798,600	16
More than 74.1	285	132.9	37,379	12	362	13,318,317	11
Total & Average	60,591	5.5	332,181	100	372	118,739,505	100

* Source: Ministère de l'Agriculture. *Statistique de la France.* Monographie du Departement de la Gironde, 1937, p. 157.

tribution of land in vineyards among proprietors in the Bordeaux region and the respective production figures. Unfortunately the data are not available for a more recent year, but it is permissible to assume that the comparative values in the table are still representative of the situation today.[17] Attention must be drawn to the fact that the table records land in vineyards and not other acreages which may be owned for the raising of additional crops or livestock.

Wines of execptional quality are generally produced by the large landholders whose property, included in Table II in the "more than 74.1 acres" category, is a chateau which stands in the countryside almost always in the midst of the undivided landholding (Fig. 5). Frequently the proprietor is an absentee owner or a syndicate. Tenancy is very rare anywhere in the vineyard areas, but there is a standard

[17] According to the Services Agricoles, Bordeaux.

retinue of personnel on this size farm, from the general manager, cellar master (*maître de chai*), and permanent workers living on the property to migrant labor which comes during harvest time. The emphasis of the entire operation is on producing the best possible quality wine, even at the risk of employing methods considered wasteful by other groups. The wines put on the market, therefore, are of highest repute and can sell in the luxury class even in difficult times. Although these chateaux give fame to the Bordeaux region, they occupy only a small portion of the wine area and produce a relatively small quantity of wine.

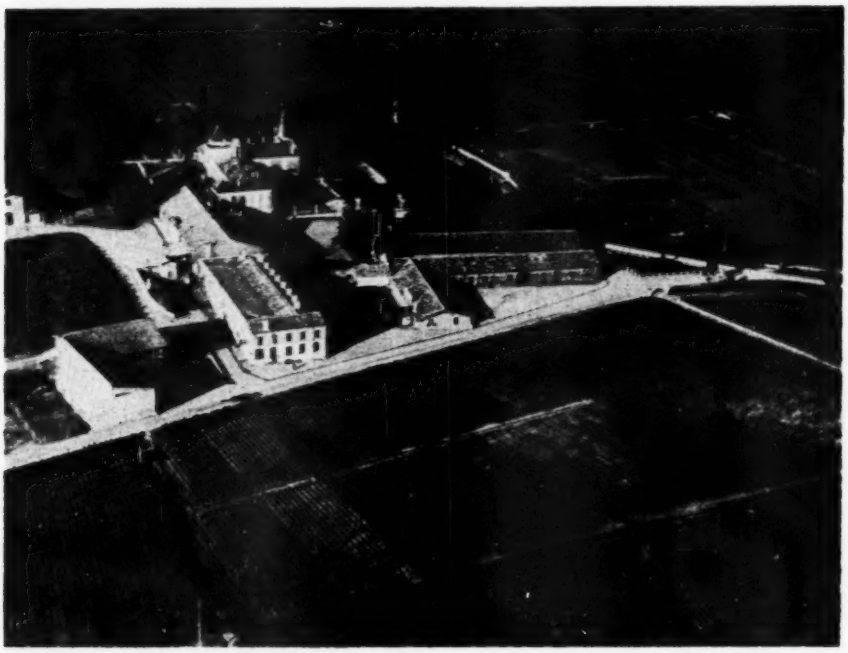

FIG. 5. Château Lafite-Rothschild in the Médoc. Elongated buildings in right center are wine storage cellars. Low, flat, marshy floodplain in background used as pasture land. Photo Larrey.

The two middle categories in Table II considered together do not represent the greatest number of land holdings in the Gironde, but their combined production amounts to about 60 per cent of the total; of this the largest share is contributed probably by holdings near the bottom of the two categories, between 7.4 and 13 acres. The house or chateau on these farms may stand in the countryside alone surrounded by the property, as those in the first group, or it may be part of a community, in which case the land holdings are divided and individual fields are scattered in the vicinity. The owner normally lives on his property, and he himself directs the operation of the vineyard in which his family takes part. If the property

is larger than 13 acres, hired personnel is needed also, because this is as much as one family can handle.

Wine from properties in the two middle categories cannot command as good a price as wine from the larger properties, because it is less well known and not regarded as a luxury item. The farmer depends ultimately on that group of consumers, in and outside of France, which in normal times is accustomed to drinking a good quality wine and can afford to pay for it. In times of inflation, however, as since the end of World War II, this wine becomes a luxury, and the producer finds himself handicapped both by rising costs of production and buyer resistance. Without having ample capital behind him to weather the crisis he is in grave difficulty, especially if he has hired labor to maintain.

The small producers are in a better position to weather crises because family exploitation permits operation at minimum cost. In fact it is in part due to this hardy group that Bordeaux viticulture has survived the many critical periods of the past.[18] The proprietors represent by far the largest number of winegrowers in the Gironde, nearly five-sixths of the total, and they occupy nearly half the land in vineyards; however, their wine production is small in relation to total area. Their homes are in farm villages or hamlets; the small plots of land which constitute their holdings are scattered, making exploitation difficult. Furthermore, if they do not have other crops and livestock for support, they must have other work to supplement their income from wine, a fact which in turn means a reduction in attention devoted to vineyards. Many of these small winegrowers hire themselves out as workers on larger vineyard properties nearby. It is obvious that they do not have the financial and technical means to produce appellation wine, and a good many have joined cooperatives in an attempt to improve the situation.

The cooperative movement was started in 1932 by small and medium-sized proprietors who were faced with just this problem of efficient production and marketing of wine. Since then the movement has grown rapidly; in 1952 there were in the Department Gironde 62 cooperatives with a total membership of 7,980 farmers; Bergerac had 10 with 1,697 members. Not only do the cooperatives have the most modern facilities for wine production, but they also obtain grapes from an extensive area which enables them to produce a homogeneous product representative of the regional appellation and certainly of better quality than any small proprietor could produce by himself. Moreover, marketing the wine by way of the cooperative is advantageous to the small grower from the standpoint of available storage facilities where the wine can remain until market conditions are favorable.

Cooperatives are found in the greatest number in areas where medium and lesser quality appellation wines are produced in as large quantities as permissible under the law (Fig. 2). Thus, of the ten leading cooperatives by capacity seven are located in Entre-Deux-Mers. The largest one in the Department Gironde, and

[18] P. Barailhé. *Le Marché et l'Entente Interprofessionnelle du Vin de Bordeaux.* Bordeaux: Thesis for the Doctorat ès-Sciences Économiques, Faculté de Droit de Bordeaux, 1951, p. 12.

in fact in France, for white wine is the cooperative at Rauzan, which has a storage capacity of nearly 3 million gallons and has 360 members. The number of cooperatives in the southern Médoc is very small and the Graves and Sauternes have none at all. In Graves and Médoc this seems to be a matter of strong individualism while in the Sauternes, it is said, production beginning with the harvest is so specialized that growers have remained independent and entirely unstandardized.

The connection between quality on the one hand and organization and financial resources on the other is not so close in the case of Armagnac and Cognac. Organization there insofar as vineyard ownership is concerned cannot be compared to the wine areas because unfortunately no comparable data are available for the departments in which brandies are produced. However, holdings on a scale equivalent in any sense to the chateaux in the Bordeaux wine area are rare, and most of the production is derived from medium and small-sized properties.[19] Their distribution pattern is similar to that in the wine areas; many proprietors live in villages, but there are in addition numerous individual farmsteads scattered throughout.

In both Armagnac and Cognac farmers distill their own wine if they have the equipment; if not, they either employ the services of professional distillers or are members of cooperatives. Unique to Armagnac are some professional distillers who operate ambulatory stills which move from village to village and property to property. The professional distiller may merely perform the service for a fee, but frequently he buys the proprietor's wine and sells the brandy to merchants and commercial houses after the distillation. In any case, the small producers are likely to sell at once, because the preparation of the brandy is a long and costly procedure.

At this stage in the production process, essential differences in the organization of each area begin to appear. In Armagnac larger farmers tend to retain at least a portion of their brandy for aging and eventual bottling, while in Cognac both steps are completed almost exclusively by commercial houses. The production of Armagnac is thus in the hands of many individual proprietors and small merchants, while that of Cognac takes place on the basis of a well organized commercial system comprising about 150 houses which have practical monopoly on purchases from proprietors. Such difference in organization does not mean, however, that the quality of the brandy is necessarily superior in one region or the other. The looser organization in Armagnac makes production more individual, which allows for greater variation in quality. In order to prevent the production and sale of low quality Armagnacs the Bureau National Interprofessionnel d'Armagnac requires that samples of all brandy destined for export must be submitted for approval, and it plans to extend this regulation to domestic sales as well in the near future. In Cognac on the other hand, the highly commercialized aspects of production tend to yield more standardized products in large quantities.

The cooperative movement in the brandy areas has developed principally since

[19] Interviews with Henri Coquillaud, Director of the Bureau National Interprofessionnel du Cognac and Fernand Sentou, President, and Jean Villatte, Director of the Bureau National Interprofessionnel d'Armagnac.

World War II. Under German occupation many of the stills had been lost because of the requisitioning of copper. To overcome the shortage cooperatives for distillation were formed among the farmers in the Charente; in 1953 these numbered about 100. The Armagnac cooperative movement became a more inseparable part of the economy; in 1953, four large cooperatives were serving their members not only for distillation, but also for vinification prior to distillation, aging, blending, and marketing. This growth of cooperatives represents a trend toward further specializa-

TABLE III

SOUTHWEST FRANCE*
LAND UTILIZATION IN SELECTED COMMUNES
1952
(Acres)

Communes**	Total Surface	Vineyards	% of Total	Grains	Meadow & Pasture	Forests	Other Use
In Dept. Gironde							
1. St. Émilion	6,432	4,626	72	30	719	74	422
2. Cérons	1,339	482	36	0	151	474	29
3. St. Julien et Beychevelle	3,855	1,112	29	35	1,161	242	79
4. Gans	1,693	82	5	262	682	492	52
5. St. Vivien de Blaye	1,376	781	55	22	336	77	29
6. St. Loubès	5,572	3,229	58	27	1,077	193	217
7. St. Martin de Laye	2,281	620	27	77	966	410	49
8. Braud et St. Louis	11,883	1,236	10	1,105	2,656	232	385
9. St. Brice	1,376	479	35	178	447	124	52
10. Blaignan	1,647	321	19	381	358	54	86
11. St. Aignan	657	247	38	5	114	25	178
In Dept. Gers							
12. Marguestau	773	153	20	151	230	64	20
13. Larresingle	2,012	319	16	620	650	86	74
14. Merens	1,011	99	10	321	368	101	12
In Dept. Charente							
15. Lignieres-Sonneville	3,939	1,458	37	420	741	418	138
16. Bonneville	2,429	91	4	583	1,134	44	161

* Source: Services Agricoles of the Departments Gironde, Charente and Gers. Uncultivated land not included.

** For location of communes see Figure 1.

tion and improvement in farm economy, but it does not indicate an increase in surface of land in vineyards or a tendency toward monoculture.

In viewing the winegrowing area of the entire southwest, one finds that vineyards are by no means the exclusive feature in the landscape (Table III). In Figure 1 the highest percentage category for acres in vineyards in relation to the total cantonal surfaces is "more than 50," but the Department Gironde is the only one which has any cantons in that category. Even there, there are only three, 51

per cent, 52 per cent, and 63 per cent respectively, all along the right bank of the Garonne-Gironde. Of the other major winegrowing departments in the southwest the leading canton in the Dordogne has 37 per cent of land in vineyards, in the Charente Maritime 35 per cent, and in the Charente and Gers each 22 per cent. There are only few sections, all in the Department Gironde and all considerably below the size of canton, where the vine takes on the aspect of monoculture. Examples are the environs of St. Émilion (No. 1 in Table III), Rauzan, and certain parts of the Sauternes, Graves, and southern Médoc. Generally, viticulture is carried on in association with other agricultural activities and also with forestry. This diversification is considered a safeguard against crises in the wine market during which other products, such as milk or wood, can offset the slack of income from the wine holdings. Thus, the gravel areas along the left bank of the Garonne-Gironde, which border the Landes forest, as well as some vineyard areas in the north of the Bordeaux region and the adjacent Charente, combine viticulture with both forest and grazing (Nos. 2, 3, and 4 in Table III). Gans (No. 4 in Table III) is removed from the heart of the wine country, a fact which is reflected in the very low percentage of land in vineyards. The raising of cattle and sheep is, however, the principal secondary activity in nearly all viticultural areas. It is especially important in the vicinity of urban centers and in areas of sandy soils between the Gironde and Charente Rivers (Nos. 5, 6 and 7 in Table III). In some parts of the Charente (No. 16 in Table III) and especially north of the Charente River it has, together with some grains, replaced vineyards altogether over wide areas. This change has taken place since the phylloxera period, but nevertheless these areas remain technically within the confines of the Cognac appellation.

Elsewhere crops are grown in rotation alongside meadows and vineyards, wheat and oats being the major cereals except in northwestern Armagnac (No. 12 in Table III) where corn takes the lead. In eastern Entre-Deux-Mers and adjacent parts of Bergerac tobacco becomes an important crop, and root crops and hay are grown between the rows of vines. Along the right bank of the Garonne and Dordogne Rivers it is the fruit tree, especially the peach, which is frequently the important alternate (Nos. 6 to 11 in Table III). In fact in some places peaches have completely replaced the vine because farmers have found that this fruit provides a more stable market.

On a departmental level the total acreage in vineyards is very small compared to total surface (Table IV). Yet these four winegrowing departments alone represent nearly one-fifth of the land in vineyards in all of France (3,458,000 acres).[20] Production of wine in the Department Gironde in 1952 was more than 93 million gallons and had surpassed the 1938 figure; however, it was below the all-time peak of 1939, when almost 160 million gallons were produced. If the figures for the two brandy regions are compared, much greater fluctuations in the production of Armagnac than in that of Cognac can be noted. In the years immediately before

[20] Institut National de la Statistique et des Études Économiques, Direction Régionale de Bordeaux.

World War II Armagnac production ranged from 120 thousand to 235 thousand gallons in terms of pure alcohol. With the outbreak of the war production rose immediately, reached 1,275,000 gallons in 1943–44, and a peak of 1,304,000 gallons in 1946–1947. Several circumstances are reflected in this expansion, among them the shortage of rum, the increased use of brandy by the Armed Forces during and after the war, as well as an increase in export in the early post-war years. Since the peak year the volume of production has been unsteady, and in 1951 amounted to only 106 thousand gallons pure alcohol. In the Charente, on the other hand, production of Cognac has tended to fluctuate less notably except in years affected by natural disasters. With the exception of two years the production of Cognac over the period of the last fifteen years has ranged between 2.1 and 3.2 million gallons pure alcohol. The more uniform production of Cognac indicates the steadying in-

TABLE IV*

LAND IN VINEYARDS IN PRINCIPAL WINEGROWING DEPARTMENTS OF SOUTHWEST FRANCE
1952

Department	Total Surface (acres)	Surface in Vineyards (acres)	Percentage in Vineyards
Gironde	2,401,600	348,000	14
Gers	1,505,000	129,000	9
Charente Maritime	1,632,900	112,000	7
Charente**	1,439,000	72,000	5

* Source: Institut National de la Statistique et des Études Économiques, Direction Régionale de Boredaux.

** Charente as used here refers to the Department Charente and not the regional name, which includes parts of both Departments Charente Maritime and Charente.

fluence of the large commercial houses which buy the wine-brandy crop regardless of general market conditions in any particular year. But in Armagnac the proprietors depend more directly on the fluctuating market and switch from the production of Armagnac to that of table wines should either the market for wine be good at a certain time or outlets for Armagnac diminish.

MARKETING AND TRADE

The marketing of wine and brandy occurs in different ways and at different stages of the production process. Most frequently the winegrower sells to a wine or brandy merchant. The merchant may be only a wholesaler who deals exclusively with the finished product, but the important merchant is a combination agent and producer known as *négociant-éleveur*. For the latter the sale may take place at any time, from the period when the grapes are still on the vine to a time years after the harvest when the wine or brandy is aged. Often the sale is not transacted directly between the merchant and the proprietor, but through a broker (*courtier*),

who knows everyone in the field and is an expert taster. It is the broker who visits different properties of all sizes and cooperatives, tastes the new wine or brandy, and advises the merchant by giving an opinion as to what the quality is likely to be. The function of the *négociant-éleveur* is a dual one, for he is an important cog in the machinery of production as well as marketing.

In Bordeaux, where the wine merchants are concentrated, the step after purchase depends on the quality of wine bought and the merchant's intentions. If his plan is to produce high quality wine, he treats the new wine, which he receives in barrels, in the same manner as the proprietor of a good chateau who processes his own crop. The merchant, however, has the advantage of being able to mix various new wines from the same region and achieve a standard quality product of high repute. Only cooperatives or independent proprietors with very large holdings are able to do this themselves. Or, this merchant also buys good aged wine in barrels, bottles it at his establishment and gives it his own label. He has a sizeable investment in his business, because he does not sell much of his wine until several years after purchase; he also needs a large plant, including extensive cellars for the aging of wine, as well as a cooperage. He makes shipments of wine only in wooden barrels or in bottles, inasmuch as it is maintained that transport in large tanks affects the wine quality.

If the aim of the merchant is volume and quick sale, new wine is shipped to his establishment in large tank trucks or sometimes barrels. There it is pumped into giant cement cisterns which are built into the walls of the plant, often two stories in height. The wine is then mixed to a uniform quality, treated as required, and after eight to ten days it is ready for shipment. The type of wine produced here is sold as an *appellation ordinaire* or as an ordinary table wine. Large quantities of it are shipped in railroad tank cars or tank trucks, some in barrels, and a very small amount is bottled. In addition, the merchant just described as well as the former buys high quality wine bottled at the chateau in order to have it in stock.

Wines of appellation and ordinary table wines are never mixed. Each merchant is under strict control by law, and a careful tabulation must be kept of how much appellation wine he buys and sells. Of course, the figures must tally.

In examining the distribution of all wine merchants in Bordeaux (Fig. 6), one sees certain concentrations in the pattern which suggest a close relationship to the port. One, in the northern part of the city, is called the Chartrons, with several satellite clusters around it; and the other, known as the Brienne, is farther south in the vicinity of the main railroad station. The former concentration can be traced back to the time of privileges in Bordeaux mentioned earlier.

In the sixteenth century it was decreed that wines from outside the *sénéchaussée privilégiée* had to be warehoused exclusively in the Faubourg des Chartrons.[21] This was a suburb, conveniently located on the Garonne River downstream from the city. It provided easy access for wines from within and from outside the

[21] Henri Kehrig. *Le Privilège des Vins à Bordeaux jusqu'en 1789*. Paris: G. Masson, 1886. p. 5.

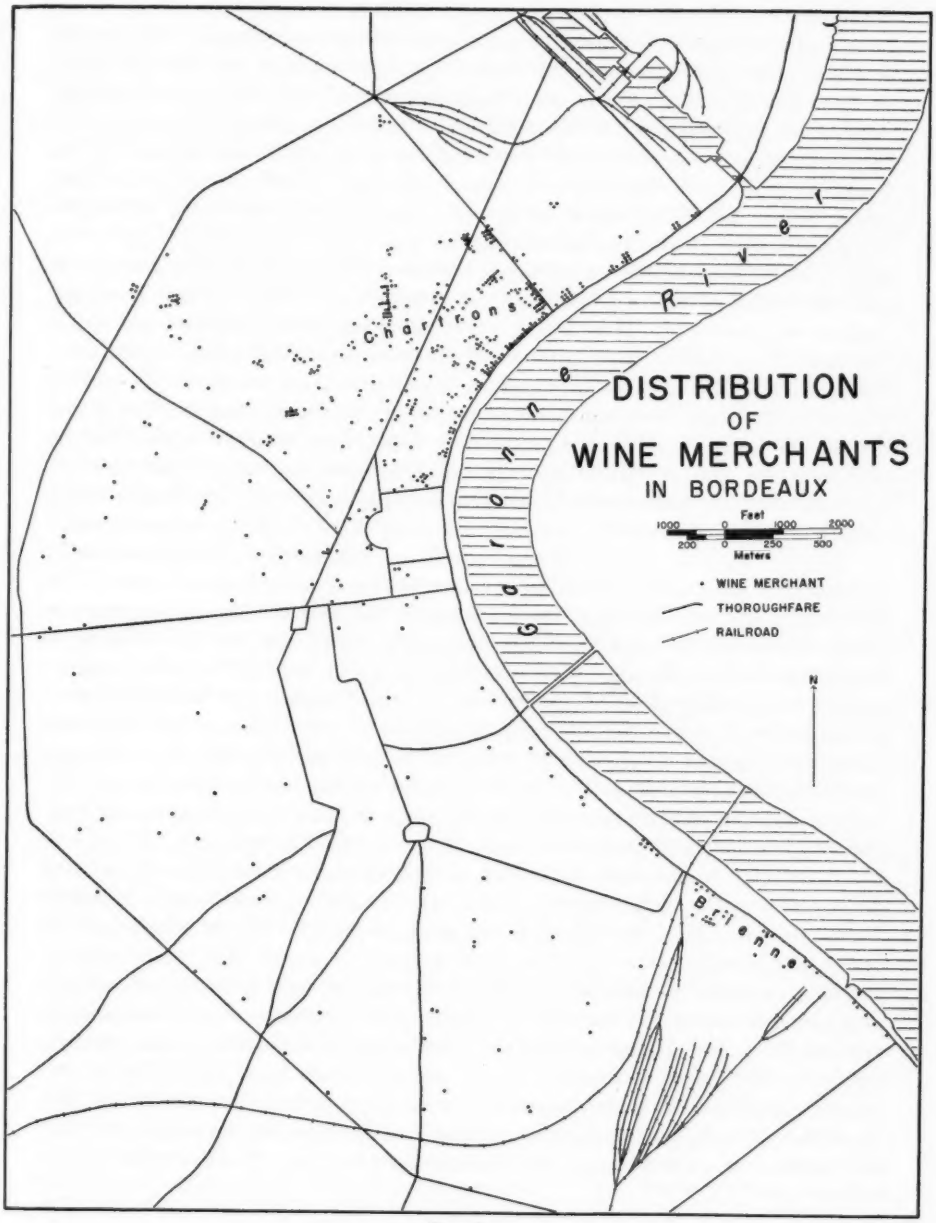
DISTRIBUTION
OF
WINE MERCHANTS
IN BORDEAUX
Feet
1000 0 1000 2000
200 0 250 500
Meters
WINE MERCHANT
THOROUGHFARE
RAILROAD
N
Garonne River
Chartrons
Bruns

FIG. 6.

sénéchaussée, and traffic moving in and out could be well controlled. Moreover, wine fleets which ascended the river annually found their merchandise concentrated in one area alongside and near the quays. Thus, by the time the wine privileges were abolished, a core of wine merchants and brokers had settled in Chartrons, recognizing the expediency of the location and in time attracting yet others.

The other concentration in the southern part of the city is also on or near the quay, but at the same time in the vicinity of rail lines. These houses are of more recent origin, and their location on the quay has no direct connection with ocean shipping because they are situated upstream and beyond the limits of the ocean port. The location did have significance, however, with respect to river transportation before the advent of truck transport; proximity to large volume producing regions like Entre-Deux-Mers and the right valley side of the Garonne; and finally with respect to railroad transportation which developed in the middle of the nineteenth century. Some of the large merchants in this area are provided with railroad sidings to handle the many shipments by tank cars. The quay location offers a convenient thoroughfare and link with the port downstream for those houses that do export by sea, and also with highways radiating from Bordeaux. Although numerically there are considerably fewer merchants in the Brienne, they handle a total volume of trade estimated at as much as two-thirds of the Bordeaux wine business.[22]

In some ways *négociants-éleveurs* producing Cognac and Armagnac can be compared to those who produce high quality wines, because they too create their product through their own individual methods of blending and aging. By contrast, nearly all the brandy merchants have their own plants, and few are wholesalers alone. Investments are often much larger than those for wine, for to produce a good brandy a long aging period is needed. Some of the commercial houses still have at hand brandy distilled in the early nineteenth century. They blend this with brandies of more recent age in order to obtain the standard desired. The merchants are located in or near the heart of the respective production areas: thus for Armagnac they are grouped principally in the towns of Condom and Eauze; for Cognac in towns such as Cognac and Jonzac, in or near the Champagne.

The Cognac commercial houses are so well organized that there are scarcely any other ways of marketing available to the winegrower besides these channels. There are possibilities for wine and Armagnac, however, some of which have already been mentioned. One of these is purchase by cooperatives, which perform the same functions as *négociants-éleveurs.* Restaurant owners and other retailers represent purchasers and have direct contact with many farmers and cooperatives without going through any intermediary. In addition, this type of sale may take place when the casual customer or visitor stops by at the farm. The wine or Armagnac merchant is also by-passed whenever the proprietor or cooperative sells directly to consuming areas in other parts of France or outside the country through the medium of large whosale organizations established in Paris or other major cities.

[22] Interview with Roger Descas, Bordeaux *négociant éleveur.*

From the standpoint of quantity France is the principal outlet for Bordeaux wines and Armagnac, but not for Cognac. The quantity of wine sold annually on the French market is not tabulated, but fairly reliable estimates[23] indicate that it amounts to approximately 90 per cent of the total. Precise statistics are kept for Armagnac and Cognac. Of the total amount of Armagnac consumed in the years since World War II, between 71 and 89 per cent has gone onto the French market except for the year 1949–1950 when exports exceeded domestic consumption. In the case of Cognac post-war consumption in France has ranged from 23 to 37 per cent, but most frequently has been in the vicinity of 25 per cent. This is much less than average French consumption in years before the war when it represented virtually half the total. This loss in the national market has been more than compensated for by a remarkable increase in exports.

There has been a notable difference in the direction as well as quantity of exports of Bordeaux wine, Armagnac, and Cognac. With respect to wine, the Bordeaux region exports to foreign countries more than any other region in France, or about 35 per cent of the total French wine exports.[24] While at one time the port of Bordeaux was the sole outlet, the bulk of foreign wine exports now leaves by truck and railroad; only on-fifth to one-fourth of the total by sea. With the development of mass transport in tank cars, means of land transportation have competed heavily with ocean ships.

Exports of wine from the Bordeaux region have increased constantly during the post-war period, but in 1952 the 1938 total had not yet been reached (Table V). Both before the war and in recent years three countries have stood out as chief consumers, and in 1952 these three countries, Great Britain, Western Germany and Belgium-Luxemburg, absorbed nearly two-thirds of the total export. The ranking consumer by far is Belgium-Luxemburg, and if one adds the figure for the Netherlands, the amount of Bordeaux wine purchased by the Benelux countries is 36 per cent of all Bordeaux wine exports. In comparison to these major markets, Sweden and the United States are poor seconds; the remainder of the trade is small and distributed over many other countries. Considered altogether, it is significant that, in 1952, 85 per cent of the total wine export was marketed within Europe and that only 792 thousand gallons, or 10 per cent, exclusive of French overseas territories, were bought by foreign countries outside of Europe.

The export of brandies, on the other hand, and especially Cognac, is characterized by a much wider world distribution (Tables VI and VII). There is a striking contrast between the quantities of Cognac and Armgnac exported, reflecting once more the difference in scale of production, organization, and capital. Both however have increased their exports considerably as compared to those before the war. The United States has been consistently the best customer of Armagnac, and the

[23] These estimates were made by the Conseil Interprofessionnel du Vin de Bordeaux.

[24] Calculated from the statistics supplied by the Services Agricoles, Centre National du Commerce Extérieur, Paris. The total wine export of France to foreign countries amounted to 21,361,164 gallons in 1952.

TABLE V*

BORDEAUX WINE EXPORTS
1938, 1948–1952
(1000 gallons)

Country	1938	1948	1949	1950	1951	1952
Belgium-Luxemburg	1,948.3	1,267.2	1,547.0	1,877.0	2,249.3	2,325.8
Germany	1,090.3	44.9	198.0	1,114.1	1,504.8	1,734.5
Great Britain	860.6	641.5	525.4	778.8	1,129.9	1,005.8
Sweden	256.1	198.0	330.0	293.0	319.4	475.2
Holland	546.5	594.0	456.7	506.9	282.5	472.6
U.S.A.	290.4	163.7	163.7	308.9	580.8	390.7
Others	1,774.1	522.7	792.0	982.1	1,140.5	1,040.2
Total foreign	6,766.3	3,432.0	4,012.8	5,860.8	7,207.2	7,444.8
France Overseas	1,602.5	897.6	1,531.2	1,082.4	607.2	396.0
Grand Total	8,368.8	4,329.6	5,544.0	6,943.2	7,814.4	7,840.8

* Source: Direction Générale des Douanes et Droits Indirects.

TABLE VI*

EXPORT OF ARMAGNAC
1938/39, 1947/48–1951/52
(gallons pure alcohol)

Country	1938/39**	1947/48	1948/49	1949/50	1950/51	1951/52
United States	2,746	3,931	30,175	68,051	45,786	13,723
Belgium	1,531	1,814	1,663	1,721	3,936	4,374
New Zealand	....	....	....	....	623	2,130
Switzerland	449	705	726	678	871	1,436
Great Britain	....	6,502	4,958	1,296	3,044	1,082
Canada	....	5	348	473	510	913
Finland	....	8	16	....	....	813
W. Germany	....	475	18	3,142	1,632	784
Netherlands	....	290	504	6,663	10,977	692
Italy	....	800	187	454	483	488
Sweden	....	227	211	180	364	420
Others	766	7,498	1,480	1,637	2,954	2,684
Total Foreign	5,492	22,255	40,286	84,295	71,280	29,539
France Overseas	....	2,957	1,663	1,716	1,241	2,170
Allied Troops	....	69,432	55,651	31,654	8,633	6,220
Grand Total	5,492	94,644	97,600	117,665	81,154	37,929

* Source: Computed from records of the Bureau National Interprofessionnel de l'Armagnac.
** Figures are available only for the three countries itemized. Distribution of "Others" is not known.

peak was reached in 1949–1950 when the United States took 89 per cent of all the exports. The chief customer of Cognac has been Great Britain and the sterling block. In fact a calculation of exports to the entire sterling area reveals that by value 47 per cent of all exports is sold within that zone, while 23 per cent is sold to the dollar area, and 30 per cent to other monetary zones.[25] Exports to the United States are especially handicapped by the discriminatory burden of the internal revenue tax. This is of particular concern for Armagnac which, as has already been seen, counts heavily on the United States as a market.

TABLE VII*

EXPORT OF COGNAC
1947/48–1951/52
(gallons pure alcohol)

Country	1947/48	1948/49	1949/50	1950/51	1951/52
Great Britain	241,571	445,289	484,804	505,956	322,326
Sweden	115,978	136,031	113,377	201,266	196,461
United States	113,322	117,887	183,110	275,059	157,413
Finland	88,709	122,050	40,144	182,926	133,452
Malasia & Br. Borneo	26,939	68,930	90,758	216,937	121,543
Venezuela	151,998	184,124	156,462	114,888	96,146
Belgium	59,704	35,817	42,963	63,957	68,434
Switzerland	43,769	29,043	37,029	48,257	58,695
New Zealand & possessions	715	1,484	3,627	26,413	48,531
W. Germany	....	275	28,913	31,706	41,546
Denmark & poss.	25,141	36,648	49,394	39,257	41,134
Canada	32,879	31,139	18,913	44,326	35,709
Ireland	23,076	21,793	23,319	57,351	27,350
Netherlands	34,154	23,897	25,244	14,140	27,295
Colombia	36,612	4,140	30,764	12,038	27,144
Others	149,860	209,819	189,873	349,315	214,320
Total Foreign	1,144,427	1,468,365	1,518,694	2,183,792	1,617,499
France Overseas	140,704	148,785	191,363	258,102	223,376
Ship & Plane Supply	....	....	4,005	7,981	8,445
Allied Troops	92,194	63,188	56,293	58,946	38,555
Grand Total**	1,377,235	1,680,338	1,770,355	2,508,821	1,887,875

* Source: Computed from records of the Bureau National Interprofessionnel du Cognac.
** Excluding Cognac used for fortifying wines (*vins vinés*).

In contrast to wine 90 to 95 per cent of Armagnac and Cognac exported moves by sea, because the markets are either overseas or to a large extent in northern Europe. The principal port serving Armagnac is Bordeaux, only small amounts going by train to Marseille or Le Havre for shipment from there. Cognac, however, is tributary to at least four ports.[26] Tonnay-Charente, located on the Cha-

[25] Bureau National Interprofessionnel du Cognac.
[26] Bureau National Interprofessionnel du Cognac.

rente River about 12 miles from its mouth, receives an average of 39 per cent of the export by sea. As small a role as it plays in shipping today, this has been the traditional port for Cognac. Until World War II the brandy was shipped on horse-drawn barges down the Charente to this port and there loaded on vessels for export. During the war the river was not in use, dredging was neglected, the locks fell into disrepair, barges deteriorated. The Charente River has not been used since, but Tonnay-Charente has remained an outlet for Cognac, because it reestablished its maritime connections with Great Britain. Thirty-two per cent of the Cognac export by sea moves through Bordeaux, also in proximity to Cognac, where a wide variety of global connections exists with regularly scheduled lines. Twenty per cent of the traffic goes by La Pallice, which since World War II has improved its status as a port and particularly its connections with Central and South America. The remainder, or 9 per cent, leaves via Marseille for North Africa and points beyond Suez.

The direction for future trade in wine and brandy has been suggested by the Cognac industry which has taken the lead in increasing its volume and range of exports. This has been accomplished with farsighted and aggressive methods of a few large commercial houses, by putting out a product of consistent quality and thereby gaining the confidence of the consumers, and by sound advertising.

CONCLUSION

To recapitulate briefly, viticulture in southwest France had its origin at the latest in Roman times. In the Gironde and Bergerac wine has remained the principal product up to the present, but winegrowers in the Charente and Armagnac in the seventeenth century turned to the distillation of wine and the production of wine brandy. Therewith certain differences in land use and methods evolved among the several viticultural centers. While the highest quality Bordeaux wines are grown on coarse gravelly soils, fertilized only little and rarely, the grapes best suited for distillation of Cognac are grown on calcareous soils and those for choice Armagnac on sands and clayey sands. In both wine brandy regions soils are fertilized with natural and commercial fertilizers so as to achieve the highest yields. Appellation regulations differ among the three regions; for appellation wine rules covering soils, vine varieties, pruning, yield per acre, and sugar and alcohol content must be observed, while for the brandies only vine varieties grown and means and methods of distillation are of importance. The prescribed distillation process is not the same in the two brandy areas. The great wines are grown on large properties in the Gironde, while the best Cognacs and Armagnacs are distilled from grapes harvested on medium-sized and small properties. In the wine areas monoculture, though rare, does exist, but in the brandy areas viticulture is always balanced by other agricultural activities. Livestock, especially cattle, is important nearly everywhere, and forestry serves as a secondary activity in some of each of the appellation areas.

Differences persist even through the aging, bottling, and marketing of wine and brandy. The finest wines are aged in barrels and bottled by the estate proprietor at

his chateau, and this is indicated on the label. In Cognac aging, bottling, and marketing are done almost exclusively by large commercial houses which have stocks of many years and which produce relatively uniform brandies by careful blending. Armagnac falls between these two extremes. Proprietors as well as merchants perform the functions, and because of less uniformity there is a greater variation in the brandy produced and marketed. Finally, the market outlets for wine and Armagnac are chiefly within France, but the Cognac commercial houses have successfully expanded their foreign markets to the point where nearly half the Cognac goes to the sterling block and an average of only 25 per cent remains in France.

Although the production of wine and brandy by no means stands alone in the economic complex of southwest France, it plays a vital role in the regional and national economy. Notwithstanding the diversification in rural and urban activities introduced over the last few centuries, at present between one-fourth and one-fifth of the total population of the important winegrowing departments depends for its living in part or wholly on the wine and brandy industry. To this must be added people engaged in secondary industries such as the manufacture of bottles, corks, cases, barrels, specialized equipment, and machinery. This emphasizes the seriousness of the repeated crises in the wine business in which the Southwest finds itself. There are so many appellations in the Bordeaux wine district that most consumers, even in France, find it confusing to choose a Bordeaux wine. This complexity is a great handicap, especially at a time when wine is difficult to market because of rising production costs, protectionist policies of other countries, scarcity of foreign exchange, and a general decline of wine consumption since World War II. Increased prices and competition with wines of other regions and with other beverages represent a greater drawback to the Bordeaux wines than to the wine brandies. Vineyard acreages for wine have actually decreased in recent years because of these difficulties, but with proper reorganization and reorientation of the trade a recovery should be possible.

France has a population which still regards wine and brandy as national beverages. The country relies strongly on the Southwest, which provides more quality wine than any other region and a substantial amount of table wine, plus the entire supply of quality wine brandy. Furthermore, in an era when France, along with other European countries, is searching for means to earn more foreign exchange, the Southwest is not overlooked as a profitable source of export items.

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REVIEWS AND ABSTRACTS OF STUDIES

BOUNDARY PROBLEMS IN EUROPE

Every war brings new boundary problems. World War II was no exception. In addition, old disputes continue and are aggravated as time goes on. This study presents briefly the present status of disputed areas in Europe, listing the most important disputes and including a briefly annotated bibliography. The following table summarizes the present situation.[1]

[1] Part of the frame of this table was taken from: Richard Hartshorne, "A Survey of the Boundary Problems of Europe," in *Geographic Aspects of International Relation,* Charles C. Colby, editor. Chicago: The University of Chicago Press, 1937. It is realized that there are many other disputed areas in Europe, but for reasons of space or absence of unbiased studies they have been left out in this study.

Disputed Area	Now Controlled by	Claimed by	Population		Approximate Date Dispute Started
			Total (000's)	Speak Lang. of Claimant in per cent	
A. Active Disputes					
1. Dutch-German	Netherlands	Germany	9.5	100	1945
2. Saar	Semi-indep. / France	Germany	943	100	1918 (870)
3. South Tyrol	Italy	Austria	340	60	1918 (1914)
4. Trieste City	UK-USA	Italy	275	80	1918 (1866)
Zone A	UK-USA	Italy / Yugoslavia	24	30:70	1946 (1948)
Zone B	Yugoslavia	Yugoslavia		80	1946 (1946)
B. Dormant Disputes[2]					
1. N. Epirus	Albania	Greece	320[4]	20	1878
2. E. Germany[3]	Poland and USSR	W. Germany	6,000[4]	?[5]	1918 (18th Cent.)
3. Karelia-Viipuri (Viborg)	USSR	Finland	400	?[5]	1945 (1940)
4. Slovenia (Yugoslavia)-Carinthia (Austria)	Austria	Yugoslavia	190	30	1918

[2] Disputes listed under "B" are either dormant at the present time, or, for various reasons, little or no discussion has appeared in papers during the last year or two.

[3] The German Federal Republic claims the 1937 boundary of Germany in the East, the Government of the German Democratic Republic has agreed to the present eastern boundary.

[4] Population figures are estimated pre-war figures.

[5] No reliable information is available.

A. 1. *The Dutch-German Border Dispute:*

Since April 1949, when the border changes were brought into effect, voices of dissatisfaction have been heard from both sides of the border, but no disturbances have resulted. The German Federal Republic suggested unofficially to the Dutch Government during 1952 that they explore the possibility of exchanging transferred land for land in the Ems estuary and the Dollard. Even though this land at one time was demanded by the Dutch in the hope that they might drain all or part of the Dollard, nothing came of the German approach. The Netherlands Government seemed to avoid any further discussion of border corrections.

Bibliography:

Lewis N. Alexander, "Recent changes

in the Benelux-German Boundary," *The Geographical Review,* XLIII, (1953): 69–76.
Scholarly paper analyzing recent changes along the whole western boundary of Germany.

George W. Hoffman, "The Netherlands Demands on Germany: A Post-War Problem in Political Geography," *Annals of the Association of American Geographers,* XLII (1952): 129–152.
Scholarly paper discussing the background of the present conflict and analyzing the claims by both parties. Description of individual claims and significance of boundary changes.

Martin Schwind, *Landschaft und Grenze.* Bielefeld: F. Eilers Verlag GmbH., 1950.
Detailed discussion of the whole border area, stressing its relationship to German lands.

A. 2. *The Saar*

During November 1953 a revised convention between the Saar and France was ratified by the French Parliament, having earlier been approved by the Saar Parliament. This new convention does not change the economic relationship between the Saar and France basically, even though the French have to some extent abandoned their economic domination of the Saar and restored coal mines and steel mills to the Saar Government. France's rights in the Saar include close customs and monetary cooperation, which means chiefly that the approximately 17.5 million tons of coal and three million tons of crude steel produced by the Saar are classified as French since they must be paid for in French currency. This also prevents a great disproportion between the production of the Federal German Republic and France within the coal and steel community, and gives France security against possible German economic and military domination of West Europe, still a real fear in the minds of many Frenchmen.

France now "favors a European or international political status for the Saar with Saarbruecken the capital of the projected European union." French-German conversations now are under way, with West German Chancellor Adenauer roughly agreeing "that the Saar should be politically Europeanized," but the economic benefits and for what period desired by France form the main obstacle to an agreement.

Bibliography:

Colbert C. Held, "The New Saarland," *The Geographical Review,* XLI (1951): 590–605
A most valuable study dealing with the political geography of the Saar, citing such factors as its enduring aspects, human aspects, post-1945 developments, raison d'etre and its implications.

Frank M. Russell, *The Saar, Battleground and Pawn.* Stanford: Stanford University Press, 1951.
A scholarly book discussing the background which leads to the present situation and analyses some of the present factors pertaining to the Saar's international importance.

Sarah Wambaugh, *The Saar Plebiscite; with a Collection of Official Documents.* Cambridge, Mass.: Harvard University Press, 1940.
A scholarly and detailed study by one of our foremost authorities on international plebiscites who was closely connected with the Saar Plebiscite Commission. The study contains 147 pages of documents and a detailed bibliography.

A. 3. *South Tyrol*

With the signing of the bi-lateral agreement between Italy and Austria in Paris, 1947, giving the German speaking inhabitants of the province of Bolzano a certain autonomy, it was thought that a new era had arrived for the people of the former South Tyrol in their relation to Italy. And there is no arguing that the position of the German-speaking inhabitants of the South Tyrol is considerably improved over the pre-war Fascist's period.

A number of disagreements remained, such as the slow permission given to those South Tyroleans who had to leave the country after the Hitler-Mussolini agreement of 1939 and wanted to return again—a total of 30,000; constant Italian immigration into the region

which affected the total number of the German-speaking population and with it the political allignment which is based largely on the number of German vs. Italian speaking inhabitants; increased industrialization and especially the building of a number of large scale hydro-electric projects which, according to the Germans, largely diminish the landholdings of the wholly German rural population. Other unsettled questions are the addition of detailed laws to the 1947 autonomy agreement, difficulties in border crossings, and the absence of a Constitutional Court, "which under the Italian Constitution should be a court of appeal in cases where local authorities believe the Rome government is impinging on their rights (Communists in the Italian parliament have succeeded in blocking the necessary laws)."

Recent Italian suggestions for a plebiscite in Trieste have kindled new hope among the German majority in the South Tyrol. Statements by their elected leaders give the impression that they are hoping to attract world opinion once again to the fact that the German population of South Tyrol wishes to return to Austria, or at least "have a real autonomy."

The Italians of this region are convinced that the new arrangement ultimately will pacify the Germans and they do not especially agree with the German argument for slowing down industrialization and immigration. But, at the same time, they point to such accomplishments as equal rights for dealing with questions of languages and culture, and the small, though important, special trade agreement between the Italian Trento and Bolzano region with the Austrian provinces of Tyrol and Vorarlberg.

It is not thought that the new agitation by the Germans of the South Tyrol will break the uneasy truce existing, but problems such as economic development in the province without fanning German nationalistic flames, and the employment of Germans in the many new factories, especially between Bozen (Bolzano) and Meran (Merano), will be major problems in the years to come.

Bibliography:

Fritz Doerrenhaus, "Duetsche und Italiener in Suedtirol," *Erdkunde* VII, (1953): 185–216.
One of the best studies discussing in great detail the position of Germans and Italians, as well as the whole development in the South Tyrol since the Paris agreement of 1947.

George W. Hoffman, "South Tyrol: Borderland Rights and World Politics," *Journal of Central European Affairs,* VII, (1947): 285–308.
A background study discussing the various factors which lead to the bi-lateral agreement between Austria and Italy at the Paris Peace Conference with Italy, in 1947.

Soelch, Johann, "The Brenner Region," *Sociological Review,* XIX (1927): 318–334.
A very valuable study by the late Professor of geography at the University of Vienna, especially stressing the fallacies in the popular concept of the "natural frontier" on the Brenner Pass as incorporated in the Treaty of St. Germain.

Guido G. Weigend, *The Cultural Pattern of South Tyrol,* (Diss. Ph.D. Chicago: The University of Chicago, 1949).
A scholarly study of the whole province of Bolzano, presenting all aspects of geographic, economic and political background.

A. 4. *Trieste and Zones A and B*

On October 8, 1953, the US and the UK announced that they would move their troops out of Trieste and turn over to the Italians that long disputed port city, including Zone A. The Yugoslavs who made claims on Zone A and for an autonomous solution for the city itself, threatened to move into Trieste if and when Italian troops marched.

It was thought that the decision to withdraw from Zone A and Trieste was the solution both the Italians and the Yugoslavs were most likely to accept, since many experts believe internationalizing of this vital area would only create additional problems. The announcement brought a violent reaction by the Yugoslavs to the surprise of some US and British officials. To the Yugoslavs as well as

to others, it looked as though this decision was a product of power politics and poor politics at that. It was felt that the US and UK are interested in the outcome of Italian policies and wanted to strengthen Premier Pella in his chances for Italian ratification of the European Defense Community. Italy felt that the announcement itself was only the result of the 1948 election promise to turn Zone A and Trieste over to Italy and put her on equal footing with Yugoslavia, who was occupying Zone B.

The problem of Trieste is complicated by years of political warfare on both sides, but especially by Italy's forced immigration into the city between 1919 and 1945, by Italian participation on the German side in occupying part of Yugoslavia during the war, and by Italy's prewar aim of controlling the Istrian region and part of the Dalmatian coast. The problem is further complicated by the strategic location of the territory between two extensive lowland regions, the Po Plains and the Carpathian Basin, extending into Eastern Yugoslavia. Also Austria's economic interests, which ships roughly eighty per cent of its goods through this important harbor, amounts to more than half of Trieste's activities and adds to the difficulty of finding a solution for the future of this area. The city can only prosper if all parties concerned—Yugoslavia, Italy, Austria, and the 75,000 people of Trieste itself—can agree in a friendly way on its future.

Many solutions have been proposed to this vexing problem, but it is becoming clear now to all parties concerned that only a compromise solution has any chance of success. It is hoped that a conference can be called in the near future to consider such points as the economic needs of the Triestini and the inhabitants of Zones A and B, the future of the port, and the whole field of political relations between Yugoslavia and Italy. The success of such a conference may well determine the future of one of Europe's most strategically located regions.

The development in this region is one more incident in the long lasting Italo-Yugoslav boundary problem, a problem which found only a temporary solution when the United States and the United Kingdom administered Zone A and the city of Trieste since the war. Since plans for evacuation were announced, various meetings have been held between the United States and United Kingdom officials and Italian and Yugoslav leaders, hoping to find some way for a compromise in the viewpoints of these two countries, with the United States–United Kingdom forces anxious to extricate themselves from this powder keg. Even though no solution has been found at the time of this writing, tempers have cooled down considerably, as expressed by the withdrawal of troops from both sides of the boundary.

Bibliography:

Anton Melik, *Trieste and the Littoral; Short Geographical Outline.* Ljubljana: Research Institute, Section for Frontier Questions, 1946.

Josip Roglic and others, *La Marche Julienne, Etude de Geographie Politique.* Susak: Institut Adriatique, 1945.

"Trieste, a collection of articles," *Review of International Affairs,* IV, 14–15, August 1, 1953, Pp. 47.

Various aspects of the Julian Region discussed by a number of Yugoslav geographers and other individuals, all presenting the Yugoslav point of view.

Diego de Castro, *Il Problema di Trieste.* Bologna: Cappelli, 1952.

Gaetano Salvemini, "The Frontiers of Italy," *Foreign Affairs,* XXIII (1944): 341–366.

Castro's study presents a detailed review of the difficult problem of Trieste. Salvemini's studies are one of the least biased published by either side in the dispute.

A. E. Moodie, *The Italo-Yugoslav Boundary.* Chicago: Denoyer-Geppert, 1946.

An excellent scholarly study discussing the geography and history of the region and various solutions proposed since 1918 to this vexed problem. One of the few unbiased studies on this dispute.

Leonard Unger, "The Economy of the Free Territory of Trieste," *The Geographical Review,* XXXVII (1947): 583–608.

An analysis of the economic importance of the city. The conclusion by the author is as valid today as it was in 1947 or in 1919. "Trieste's economic position is dependent on a relatively free movement of goods in world trade."

B. Dormant Disputes

These disputes for the time being are not "making the daily headlines," even though some of the solutions may in many ways be more difficult than those discussed above. The problems of Germany's eastern border can only be solved among the big four powers and in conjunction with a solution of the whole German problem. Perhaps no solution is possible at all for the present. The question of the German inhabitants of former Silesia, parts of Posen, Danzig and East Prussia, brought up at the Potsdam meeting of 1945, alone shows the complexity of a satisfactory solution.

Greek claims to N. Epirus now within Albania involve many problems, most of all Albania's relationship to Italy and Yugoslavia.

Recurrent news reports during the past weeks of Russia's reported willingness to exchange the city of Viipuri with territory in Lappland point to some renewed activity in the unhappy Finnish-USSR relations. The problems of the Slovenians in the Austrian province of Carinthia have for the time being found a satisfactory solution, with Austria granting the Slovenian minority considerable cultural autonomy. With Yugoslavia's hope to influence Austria in her behalf in the Trieste conflict and Austria's economic interests in a solution of the Trieste, conflict, both countries have succeeded in improving their relations.

Bibliography:

C.H.G., "Greek Claims in Southern Albania," *The World Today,* 1946, pp. 488–494.

A short summary discussing the historical background to the Greek claims of Northern Epirus and especially stressing the difficulties in coming to a satisfactory conclusion in an area of such long standing political and cultural intermixture.

Hundreds of articles have been written in Germany, Poland, and in this country on "Germany's Eastern Boundary." I have found not one study analyzing all the problems of this complex border dispute in a scholarly objective way. In am therefore not even attempting to cite individual studies.

W. R. Mead, "Finnish Karelia: An International Borderland," *Geographical Journal,* CXVIII, part 1, March 1952, pp. 40–57.

This valuable study analyzes Karelia under such headings as character, allegiance, aspirations and dispersion. It concludes that the Finnish Karelians today "are a people without a land, their ceded home province is now a land without a people."

K.R.S., Slovene Carinthia, The Austro-Yugoslav Frontier Question," *The World Today,* September 1947, pp. 389–397.

An unbiased study analyzing the historical background to this dispute.

In conclusion it should be said that the task before Solomon was easy as compared with that confronting the Allies in Europe today. But the age old conflicts must be settled and old ambitions and ancient hatreds finally must be dissolved.

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WATER SUPPLY IN TEXAS

Water Supply and the Texas Economy,—An Appraisal of the Texas Water Problem, U. S. Department of the Interior, Bureau of Reclamation, Area Planning Office, Austin, Texas, 1952. 96 pp., 16 maps, 42 graphs, 10 Tables, 1 chart.

Over the past several years the Area Planning Office of the Bureau of Reclamation at Austin, Texas, has concentrated a considerable portion of its planning activities in a comprehensive, state-wide study of water conservation problems and potential solutions for the State of Texas. Data and information have been collected and analyzed, sufficient in ex-

tent to define clearly the character and magnitude of the major water problems facing Texas and to point to desirable solutions. Therefore, this report has been made available to the people of the area who are primarily concerned as an aid and stimulant to reaching required decisions.

The report is in two main parts. The first part is a summary appraisal of the existing water problem including a presentation of the economic background, an identification of Texas water problems and water supply problems, and suggestions for a state-wide water policy. The second part consists of supporting data. It is this section which contains the very valuable maps, tables, and graphs pertaining to all phases of Texas' water problem.

For purpose of analysis the state is divided into four general water supply problem areas; Gulf Coast Area, Central Area, High Plains Area, and Pecos Valley-Trans Pecos Area. Information on each area is presented separately.

As would be expected in a state with such great climatological variations, the water problems are many and varied. While the eastern part is concerned mainly with flood control the western part is concerned mainly with adequate water supply.

However, the greatest overall problem seems to be the widespread dependence on depleting ground-water resources. To quote the report: "At present the State irrigates over 3.7 million acres, or about 15 percent of the irrigated acreage in the 17 Western States. Irrigation accounts for 85 percent of present Texas water use and 13 percent of total Texas harvested acreage, which produces 40 percent of the gross Texas agricultural income from harvested lands. *Sixty-five percent of the irrigation (or 2,400,000 acres) is dependent upon depleting ground-water resources and to a large extent cannot be considered as a permanent part of the future agricultural economy of the State.*" (italics by author of review) (p. 10)

The phase of this report gaining most attention, however, is the recommended solution for the problems of the Gulf Coast Area. The solution reported for this area would involve westward transfer of water from the water-surplus portion of the Gulf Coast to areas of water deficiency. This westward transfer would present no great engineering problem due to the absence of major physical barriers. However, such transfer of water would face major economic barriers as the cost is estimated at approximately 1.1 billion dollars. The study suggests such cost is not prohibitive when considered from a joint Federal-State approach since the undeveloped mineral and agricultural resources of the State have both national and state implications.

This report presents an accurate summary of existing conditions and can be of considerable assistance to all who are concerned with the overall solution of water problems in Texas. The many charts, maps, and graphs, are of valuable assistance in studying the geography of Texas.

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The Plane Table

Response to the first appearance of *The Plane Table* has been extremely gratifying, if not wholly edifying. Many of the members of the Association have been considerate enough to take time to write the Editor brief notes expressing varying degrees of satisfaction. The Editor thanks them sincerely for having done so. Usually the letters received by the Editor contain brimstone and damnation; and the change is a wonderful experience. Further, as this issue shows, something positive has been done. That is the main purpose of this section. Let's hope the purpose will continue to be served.

* * *

From time to time an occasional summary statement of matters geographic comes either to the Editor of *The Professional Geographer* or to the *Annals*. The material in such summaries is often not of a research nature suitable to the *Annals*, nor of a length suitable for *The Professional Geographer*. Yet, the note is often enough useful to a good many geographers. As an experiment, some of this material is being printed in the REVIEWS AND ABSTRACTS OF STUDIES section in this issue. The second part of the title of that section would indicate that this might be the proper place for an occasional note of this type.

* * *

Comment on "Exceptionalism in Geography."

1 December 1953

The article on "Exceptionalism in Geography" by Fred K. Schaefer in the September 1953 issue of the *Annals* purports—at least in the first two-thirds which fits under the title—to preesnt a challenge to certain views about geography that were presented in my study of *The Nature of Geography*.

If the article represented an essay in methodological debate, I should either endeavor to offer rebuttal or rest my case. But I find little in it that constitutes reasoned disagreement with the views that were actually presented in my work. Rather, a major amount of the material in the article is presented to demonstrate that the thesis, or theses, in that volume were developed by 1) use of statements of students who were not competent in the field at time of writing, 2) radical misunderstanding of published statements, and 3) omission of readily available statements or sources that oppose the views presented.

The implications of these criticisms affect not only the volume under criticism but also the writings of a number of students on whom that work depended, not only those named in the article—Kant, Humboldt, Ritter, Hettner and Kraft—but also numerous others—such as Penck, Döring, or Plewe—whose writings were important sources for the conclusions stated in the volume under criticism but which are not mentioned in the current article. While most of these authors are no longer living, their writings form a living part of our literature; such criticisms, whether asserted or implied, should not stand unchallenged in the professional journal of our Association.

One might expect that criticism of this character, to merit permanent place in our professional literature would be no less meticulous in scholarship than the original work criticised. In order to demonstrate that the views of earlier writers had been misinterpreted, correction, one might expect, would require direct quotations of the statements said to have been misunderstood, or, if paraphrasing were unavoidable because of length, that citations would be complete and precise. In implying, or asserting, that important views or critical sources had not been used, one might expect evidence of reasonably diligent search to make sure that had been the case—at least to the extent of checking through the indexes of the work under criticism.

The lack of such evidence in the article makes it difficult for the reader to determine the correctness of the criticisms offered. Since however most of the discussion deals with information and views that are included in one volume and that is equipped with author and subject indexes, it is possible to check most of the statements in the article with the pertinent statements in that work, even though most of the latter are not cited in the article.

A large number of these will be found on the following pages of the *Nature of Geography:* 38f., 57, 77, 135, 140–146, 366 ff., 374 ff., 383 f., 391, 395 f., 431 ff., 456–459.

To make such a check however requires several hours. Your readers may therefore welcome the conclusions to which I have come after carrying out detailed comparisons. I find that the following statements apply generally, or even completely. 1) Views attributed to the author of *The Nature of Geography* or to other writers on whom he depended which are held to be erroneous in the current article were not in fact asserted by any of those writers. 2) Views of the writers on whom the original work depended which the article asserts were omitted from that work were in fact included therein. 3) Sources introduced into the article as though new were in fact included in the original work and used therein more fully and more accurately than in the current article. 4) Conclusions presented in the article without source, as though they were the views of the author in opposition to the views presented in the original work, were in fact presented, with citations, as conclusions in that work.

The following findings are not so readily determined, but a careful reader might well suspect from the manner of presentation what can in fact be fully documented.

5) The biographical conjectures concerning the scholarly purposes and competence of various authors discussed are not only unwarranted in a learned journal, in view of readily available and authoritative biographies, but are found to be very bad guesses. 6) The presentation of Humboldt's views concerning his work in the *Kosmos,* a series of paraphrases supported by citation to a single page of the original, is a garbled maze of phrases collected out of more than forty pages in the original volume and put together, with additions, in such a way as to present quite the opposite meaning from that of the original.

I would not, of course, make such statements were I not ready to demonstrate their validity. It has been suggested to me, however, that more positive value would be gained if I would take each of the half dozen questions concerning the character of geography on which there is evidently confusion in the minds of many geographers, confusion compounded by the publication of this article, and present a direct statement of clarification on each. I am therefore preparing such a presentation for submission to the *Annals,* together with whatever footnote corrections of specific errors in the recent article are considered necessary and appropriate. Since, however, the responsible documentation of error is one of the slowest and most tedious of scholarly tasks, this cannot be submitted at once; in the meantime this letter will serve as a *caveat* to students of methodology and the history of geographic thought.

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